

Editorial

Rapid incorporation of technology in health-care management – Blessing or curse?

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INTRODUCTION

Survival (and potential cure) of several cancers have significantly increased. Progress over the decades has resulted in incremental gains. Technological advances are the major contributors, directly or indirectly. We have always been fascinated by immortality since time immemorial. Hope has been spurred further by the improvements in life expectancy. As a result, we live in a world of unrealistic expectations. The hype about technological advances fuels this image of living forever. For instance, national geographic and Time magazines have both published issues with the cover showing today's babies living up to the ripe age of 120 years. Cancers, ischemic heart disease, and diabetes mellitus are diseases of the elderly; our current lifestyle is responsible for its rise at alarming proportions. Doctors and healthcare professionals are faced with the following challenges - better longevity, increasing lifestyle diseases (including cancer), emerging innovative technology that might help healthcare (potential but not enough data) on one hand and unrealistic expectations (from patients, their caregivers, friends and general public) on the other hand. Launch of chat generative pre-trained transformer (GPT) (ChatGPT; on Nov 30, 2022) and the subsequent availability of GPT 4.0 revolutionized how information flows globally [Table 1].^[1] The platform uses the fifth-most powerful computer in the world, having over 2,85,000 cores; 10,000 central processing units (CPUs); and a processing ability of 400 gigabits per second per server. Now every bit of medical information, technological advances, and its applicability in healthcare is available at our fingertips in a fraction of second. Sometimes, people think that the availability of such information makes them doctors (or even better than their doctors) – instances of lay people attempting to operate on themselves/their family members (with disastrous results) are well documented on the internet. Since ChatGPT has the ability to pass United States Medical Licensing Examination (USMLE) (equivalent to 3 years of solid studies as a medical student), is it a credible threat

Table 1: Timelines to reach the milestone of one million users.

S. No.	Program	Time to reach one million users
1.	ChatGPT	5 days
2.	Instagram	60 days
3.	Spotify	150 days
4.	Facebook	300 days
5.	Netflix	3.5 years

GPT: Generative pre-trained transformer

to our health-care professionals? When ChatGPT is asked about the basics of biology, its answers are detailed, precise, and clear. Even when it is asked to define the risk of cancer, diabetes mellitus, or stroke and their management outcome in a specific setting, it does a fairly good job (ChatGPT's data up to September 2021 and GPT 4.0 more current data). If we go further, to recommend a line of management for a particular stage of the disease in a specific patient, the replies become very general and are followed by a disclaimer about its limitations. Its output is similar to what is already available on Google Search. The difference is that Google lists lakhs of online sources of information which are expected to be scanned one by one (an impossible task) whereas GPT does the background work for us and provides a structured synopsis. Both also give out a list of other sources where the user can search for more detailed information. When it's a rare case or circumstances beyond routine care, the answers are vague and not very useful. In conclusion, oncologists and other cancer health-care providers have nothing to fear from ChatGPT - YET!

The concern is regarding algorithm bias (racial, ethnic, geographic, and preferential). Let us take an example of IBM Watson, which was touted as the biggest solution for oncology needs. However, world leaders like MD Anderson Cancer Center quickly stopped using it. They realized that the AI program mirrored all the biases in the minds of its

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medical support team, the Memorial Sloan Kettering Cancer Center. Similarly, AI algorithms are biased towards project managers and leaders only from the Caucasian/white race. Moreover, this was at the cost of 60 million USD!

CLINICAL EXAMINATION, IMAGING, PATHOLOGY, MOLECULAR DIAGNOSTICS, AND BEYOND

In olden times, the clinical acumen of the physician was of paramount importance. This was the only way of arriving at the right diagnosis. The art of history taking and physical examination is still important. However, their applications are being reduced by complementary technology. We started peeking into the human body using radiology (X-ray, ultrasound, computed tomography scan, magnetic resonance imaging scan, and positron emission tomography scan) such that lesions measuring a few mm could be easily identified. Putting the biopsy under the microscope allowed us to ascertain the nature of cells admeasuring a few microns. Today, both these techniques are considered a standard of care without which no patient can be managed accurately. However, this was not enough. Cells functioned (normally or abnormally) based on the genetic code within their nuclei. Hence, we developed techniques that would unravel the information contained inside the DNA. Next-generation sequencing made it possible to identify driver mutations and genetic instability that dictated the growth and behavior of cancer cells. As the price of genetic profiling dropped from millions of US dollars to a few thousand INR, this technology exploded everywhere. Today, we are talking about liquid biopsy, using a drop of blood to unravel the oncology mysteries of individual patients, a true example of personalized medicine, precision oncology, and targeted therapy. We can now diagnose down syndrome by taking a tiny sample of the pregnant lady's blood. Our tests have become so sophisticated that bits of circulating fetal DNA can be amplified and distinguished from the DNA of the mother.^[2] Bye-bye to invasive amniocentesis, with its inherent risk of damaging the yet-to-be-born child. Today, this may be applicable to a small fraction of our patients. However, technological advances, coupled with access to humongous publicly available databases and enhanced bio-informatics computational power are allowing the enrichment of patients that benefit most from such approaches. International online collaborations constantly update the system so that single nucleotide polymorphisms that were of indeterminate significance are quickly reclassified into pathogenic or benign.

DA VINCI ROBOTIC SURGERY SYSTEM

Industry robots have been used in manufacturing and assembly lines for long – and have led to job loss and money saved. Curiously, it has led to poorer quality cars (my

mechanic who worked for BMW earlier, said he would not buy the car if manufactured after 2013). However, the problem is even bigger. Industry robots result in approximately 5,000 deaths of workers every year (two examples from 2015 are Wanda Holbrook [Ventra Lunid, Michigan, USA] and Ramji Lal [Manesar, India]). We would logically expect that the application of robots in healthcare would be regulated more strictly. However, the case of the popular da Vinci robotic surgery system leaves much to be desired. This surgical robotic instrument costs \$1.4 million (about 11.2 crore INR) plus annual maintenance of an additional \$100,000 (about INR 80 lakhs) with a projected life span of only 5 years. By 2021, more than 6,700 such units have been installed in various hospitals globally and about 85 lakh surgeries have been conducted using this device. I was surprised to find out that surgeons are considered qualified to use this system after a basic 2 h training program, having hands-on operating experience of the robotic system for as little as 5 min. No wonder it has caused at least 294 deaths, 2,000 injuries, and 17,000 instances of device malfunctions (malfunctioning arms, freezing of controls, and electric problems).^[3] In 2013, the United States Food and Drug Administration (US FDA) was forced to issue a warning to the manufacturer. More than 3,000 lawsuits are pending against Da Vinci Robotic systems, which the company expects will cost them upward of 67 million USD for settlement.

HYPERTHERMIC INTRAPERITONEAL CHEMOTHERAPY (HIPEC)

HIPEC has been around for more than a decade. It is a novel, FDA-approved treatment, in which all visible tumor is resected and the abdominal cavity is perfused with heated chemotherapy to enhance tumor killing and chemotherapy effect. It has become the standard of care for mesothelioma and appendix peritoneal metastasis, where along with cytoreductive surgery, it has improved 5-year survival from <50% to as much as 90%, yet, in other indications (e.g., colorectal cancer, ovarian cancer) most publications still end by stating that more prospective data and trials are needed. In fact, the European Society for Medical Oncology has removed HIPEC from its guidelines for ovarian cancer. With the cost of HIPEC being about INR 5,00,000, its use as a palliative therapy should be questioned. The other side of the coin is that innovative thinkers have found a way of adding indigenously made modules to an existing cardiac bypass machine to make available low-cost HIPEC equipment.^[4]

CHIMERIC ANTIGEN RECEPTOR (CAR) T CELL THERAPY

CAR T cell therapy is another technological advancement that provides customized solutions for patients' living cells for treating cancer. It was a new hope for some patients with cancer who had failed multiple lines of therapy. With impressive

remission rates of about 60%, there was a glimmer of long-term benefit. However, the pendulum is now swinging the other way. The initial product launched by Novartis was priced at the equivalent of INR 3,60,00,000. Even with LMIC developing its own CAR T Cell Therapy manufacturing programs, the cost remains high (at least INR 25,00,000) and proven applications are limited. Hence, utility outside of a clinical trial should be with extreme caution. On the other hand, several companies (including those from low- and middle-income countries) have successfully made their CAR T cell therapy products available for human trials. To take one example, Dr. Gaurav Narula from Tata Memorial Center spearheaded the group that collaborated with the Indian Institute of Technology to develop the first indigenous CAR T cell therapy from India. No wonder, he was honored with the title of “Father of CART” in India and was invited to give the prestigious Geeta Ramesh Chandra Gandhi oration during the 48th ICON conference in Lucknow.^[5]

PROTON BEAM THERAPY

Using protons instead of X-rays was developed about 60 years ago (1954). It received US FDA approval for use in cancer patients in 1988. It can give therapy in a more precise manner, reducing side effects to surrounding tissue. Hence, its main value is in treating pediatric cancers and those in the central nervous system (close proximity to vital organs).^[6] The equipment is huge and setting up such a facility costs upward of INR 500 crore. The cost of each treatment is at least INR 30,00,000. It has not been proven to give superior survival or cure rates. Hence, its indiscriminate use should be discouraged. Intensity-modulated radiation therapy/image-guided radiation therapy gives similar results at a fraction of the cost.

NEURALINK

For patients with paralysis, severe tremors, and parkinsonism options are grossly inadequate. This led to the concept of Brain-Computer Interface. In the USA alone, 150,000 such patients have undergone brain implants. Elon Musk and his company Neuralink, want to go further by providing a direct connection between the brain and the outside world, allowing a person's thoughts to directly control devices. After years of back and forth, the US FDA has finally given them approval (May 25, 2023) to initiate their Precise Robotically Implanted Brain-Computer Interface study in humans.^[7] However, this study is only a shadow of what Elon Musk has been touting – telepathy marrying artificial intelligence (AI). It's more like Stephen Hawking's use of eye/cheek muscle movements to communicate with the rest of us through a computer interface. It is a far cry from replicating Neuralink's video showing a monkey playing Pong (a classic video game) on the computer, that was viral on social media 2 years ago (2021). Other companies in this field also include Blackrock Neurotech, Synchron, Stentrode With Thought-Controlled Digital Switch, and Paradromics. If the announcement of US

FDA approval for Neuralink made the company's valuation jump from 2 billion USD to 5 billion USD, its future implication on health-care costs is obvious.

EFFECT OF TECHNOLOGY ON HEALTH-CARE PROFESSIONALS

There are several examples of how technology is making our jobs easier. Sensors on hand bands allow us to seamlessly monitor more than 27 parameters, including heart rate, oxygen saturation, rapid eye movement, sleep, and blood sugar. Telemedicine helped save thousands of lives during the recent COVID-19 pandemic. Our multitasking is facilitated and our brain power can be multiplied manifold. However, gadgets are not without their downside. Electronic medical records (EMR) have resulted in doctors having to spend five hours filling in meaningless details – precious time is taken away from direct patient management and hence, a steep fall in doctor-patient interactions. When he was the president of the USA, Mr. Obama pushed for EMR under the 2009 American Recovery and Reinvestment Act and spent billions of dollars on this technology. Fearing they would lose medicare reimbursement, 98% of American hospitals adopted it. Fortune magazine and Kaiser Health News recently published a scathing criticism of EMR – citing alarming reports of thousands of patient deaths, serious injuries, and near misses, as a result of software glitches and other flaws. Automated systems, machine learning, decision-processing algorithms, and AI are supposed to flag potentially dangerous drug interactions or conflicting orders. Unfortunately, EMR systems often fail to do so. In a 2016 simulation of hospital electronic health records (EHRs), the system failed to flag 40% of potential errors, a whopping 13% of them could have been fatal.^[8] While EHRs were projected as the best technology to improve the outcome of patient management, these records have shattered healthcare for both patients and their doctors.

We are also beginning to see new diseases as a result of overuse of electronic devices – such as text neck/thumb, selfie elbow, screen insomnia/eyestrain, keyboard plantar fasciitis, and anxiety due to social media likes. Their use indirectly results in reduced physical activity and facilitates obesity, with an increase in diseases linked to a sedentary lifestyle. Some remedies include using voice commands, taking regular breaks from screen watching, correcting posture, switching off devices at least one hour before bedtime, and social media detox holidays.

THE FUTURE

“One world, one people, one future” was the motto announced by the prime minister of India during the G20 summit of 2023. It is also the mantra that we need to imbibe as our life's mission. While technological advances are good for humanity, medicine, and patients, they have to be used

judiciously. Health-care costs cannot be allowed to escalate to such an extent that they grow larger than the GDP of the country. Cost-effective, cost-benefit, and cost-prudent solutions are the need of the moment. While no value can be placed on the life of the individual, there has to be an objective quality-adjusted life years analysis before recommending any therapy as standard of care, especially when the bill is being paid by the government or someone other than the patient. Success has gone beyond borders and boundaries with significant benefits. It is now time for the business behind health-care technology to think beyond their bottom line and be patient-centric. It is also time for the patients to realize that they have duties that go hand in hand with their rights. The benefit of technology can only take us so far – after the horse has been brought to the water, he has to make efforts to drink it himself. The use of technology has to be followed by due diligence and implementation of health-care advice by each individual to receive its full benefit.

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