Technology in health care, prudence against exuberance, warning against inertia

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Louis Pasteur's discovery of bacteria and vaccine has set the conflation of scientific inquiry and health care on an irreversible course, the benefits of which we are still experiencing. Inventor of the principle of vaccination[1], he heralded massive public health practices that have made great strides over the years in halting or ridding our planet of scourges such as anthrax, influenza, polio, typhus, typhoid. The process of sterilizing milk has taken its name, pasteurization; infected milk used to be a source of bovine TB jumping species and affecting humans. Other successes included the invention of antibiotics in the early part of the 20th century[2]. Better hygienic conditions, advent of antibiotics and vaccines have reduced infectious diseases tremendously.

The spectacular success of technologic advances and their application to make significant difference in therapeutic interventions doubles as an Achilles' heel. Several unintended consequences have resulted. In the case of antibiotics, overuse has resulted in drug resistance, a matter of increasing frequency[3]. This takes even an alarming concern for slow growing bugs that require long treatment for eradication; TB is the poster child of such a tragedy[4].

In the case of medical equipment, an infatuation with new technology begets a tendency for less than rigorous vetting. A good example is robotic surgery. Hailed as a game changer, albeit an expensive toy, physicians in the US have jumped on the bandwagon for unapproved procedures such as breast, prostate cancer surgery but the data don't support superiority over traditional methods and furthermore, for gynecologic cancer surgery, there's an increase of mortality and recurrence[5,6]. Technology is a great but double-edged tool. Exuberance over technology needs to be tempered.

Prudence against exuberance is not meant to be taken as a vote against the use of technology. In fact the risk/benefit ratio favors the use of technology. While the use/misuse of robotics in surgery sits at one extreme, the prevailing scene in our homeland represents the other with a dearth of technology, resulting in limited diagnostic capabilities for the rich as well as the poor. Préval as president had to travel to Cuba for treatment of his prostate cancer[7]. Baby Doc had a massive heart attack and died, with no access to thrombolytic therapy[8].

For some, talking about the use of technology and medicine in the same sentence is heretic's talk. Medicine is regarded by some as more art than science and the human touch or bond that needs to exist between the practitioner and the patient is a sacred cow. Certainly one can argue about overreliance on machines to make diagnosis and relegation of physical exam to an afterthought. This is a valid point and one that needs to be made again and again[9]. However, the greater truth is that technology is not supposed to compete against practitioners but be a useful tool to help carry out the duty at hand. In evaluating the role of technology in health care, this concept needs to be kept in mind. This greater truth indicates acquisition of knowledge about the mechanisms of disease process and all its different nuances helps in establishing diagnosis and treatment plan; the art part by itself doesn't suffice. The science part of the craft is becoming more and more important. Technology as a tool is a useful means but not a panacea. Its use should always be subject to reevaluation lest we become lax and that can be fatal. No man-made creation is foolproof.

Nonetheless medical research over the years has been fruitful and has created new therapeutic interventions, along the way accumulating a good track record. One can cite the discovery of H2 blocker for treatment of peptic ulcer to usher a downward trend in complications of the condition and a marked reduction of surgical interventions resulting in an improvement in the quality of life of patients[10,11]. This great success is followed nowadays by overuse of proton pump inhibitors, and now we are witnessing epidemic proportion of heretofore uncommon diseases such as *C. difficile* colitis[12,13,14], in another reminder of the pitfalls of overreach.

The digital revolution has taken the practice of health care by storm. No longer do we need to lug a large PDR, instead the same information is available as an app. Several apps make our lives so much easier (Table 1).

Table 1 Medical digital app list

NAME	DESCRIPTION
Medscape, Medpage Today	CME, news, drug info, wide clinical database
Epocrates	Drug info, clinical data, athenaText for secure cmmunication
iRadiology*	Learning tool for radiology imaging
UpToDate, DynaMed Plus	Medical textbook updated continuously
CCO Oncology in Practice*	Digital textbook with latest info
Lexicomp	Reference app for ID, toxicology and oral diseases
Omnio	Provides access to a bevy of database such Merck Manual, ADA, National Comprehensive Cancer Network, and so on.
Visual DX	Library of > 32,000 digital images of diseases
Unbound Medline	Access to Pubmed's database
Case	Management of reading medical journals
QxMD Read, Docphin	Access to medical journals
Psych Drugs*	Psychotropic meds
MDCalc	35 areas of specialty, >150 diseases; helps in diagnosis
Doximity, Figure 1	Social network/secure sharing of information or medical images
EyeChart*	Snellen eye chart to measure visual acuity
PEPID	Helps ER physicians make diagnosis
ASCCP Mobile	Helps to manage cervical cancer screening
AHRQ ePSS	Created by US Dept of Health. Emphasis on preventative care

* iPhone or iPad platform

The question is, how does society pick and choose technology for its health care? For everybody in the world except here in the US, government intervention sets the tone for price of drugs, procedures, acquisition of expensive equipment. Arguably a hands-off policy allows the market forces to dictate the rules of the game. However in reality, in health care, economics follow a different curve. Any piece of equipment allocated for health carries a higher price tag and with time, unlike consumer electronics, it keeps going up. There tends to be little competition and this can lead to profiteering. Drug prices in the US are the highest in the world[15,16]. Competing products match prices and don't undercut each other. A glucometer can be obtained for a low price but the sticks needed to test the blood sugar are expensive. It is clear then ideally technology should be cost-effective. Lifesaving measures such as Pap smear for screening of cervical cancer can't be implemented if the cost of the test is elevated. Testing for glaucoma as a means for fighting against blindness is handicapped if the cost of eye drops is out of reach. Technology is supposed to come up with a solution that makes economic sense, hence the term appropriate technology. When financial resources are limited, decisions need to be very cost-sensitive or cost-conscious. High cost of devices or treatments has led to a movement of innovation at grassroots level: end-users like nurses, physicians, patients are starting to make devices more user-friendly, simpler, cheaper. This movement is growing and carries the pedigree of academia. MIT has "The Little Devices Lab," that "explores the design, invention, and policy spaces for DIY health technologies around the world." (littledevices.mit.edu). Another interesting site is a clearing house, Market Health (markethealth.com). Joining the fray is a British company, Owen Mumford (owenmumford.com) that specializes in inexpensive drug-delivery devices, including pens, needles, auto-injector. The use of this auto-injector filled with epinephrine is being used as an alternative solution to the very expensive EpiPen[17,18].

The changes taking place straddle the micro/individual environment as well as the macro/systems. In both cases, the prevailing idea is that access to data/care is being democratized. What's good for the goose should work for the gander. What needs to be grasped is the expansive armamentarium available for cost-effective solutions. High speed internet access is the equalizer, if not sine qua non. Among tried and proven methods:

- **Telemedicine**, a real game-changer, providing access to health services from remote location. This distance-neutral formula benefits poor and affluent environments. In practical terms, inaccessible regions can have a physician directly supervising or offering care via video or convenient interpretation of imaging (echo, CT/MRI, ultrasound, EKG) from distance in both (most large medical centers in the US at night have imaging studies read from a remote location either in the US or India).
- To standardize health care delivery, The World Health Organization has published a compendium in 2018 of The Model List of Essential In Vitro Diagnostics (EDL)[19]. It is an interesting document as it includes some practical, real-time tests for malaria treatment, quick diagnosis of TB (using molecular biology tools) and HIV and or their co-existence as well testing for drug-resistant strains. This is par excellence a superlative use of technology for the common good. In a country such as ours with a high prevalence of infectious diseases, this should a good start. In 1977, WHO had also first published a list for essential medicines, a move that was fought by big pharma. It has updated it regularly since[20]. Inclusion of a diagnostic test or medicine in the list respectively gives a poor country's government leverage to negotiate its acquisition at a low-cost price. Unfortunately, neither list is being implemented to its fullest in our homeland[21].

- **Unitaid** (unitaid.org) helps poor country reach access to expensive patented antimicrobials and maintain a database of such meds, MedsPal.

Over past 10 years an acceleration of breathtaking developments that have far reaching consequences for humanity have been drowning us. Let's mention:

- **Artificial intelligence**. It's best understood to be a tool that relies on vast database to absorb, interpret and regurgitate patterns. Even though it holds a lot of promises, it's an evolving technology and still fraught with imperfections, glaring and expensive failures. Watson, the famous software developed by IBM that beat a grandmaster in a chess competition has been tested for use by oncologists with varying results. MD Anderson, the famous cancer hospital in Houston, lost $62 million trying install Watson[22]. University of North Carolina Lineberger Comprehensive Cancer Center has found it to be some help in retrieving some clinical trials unknown by physicians[23]. So far, AI in medicine seems to work best in specialties that rely on pattern such as Pathology, Radiology, Ophtalmology[24]. A study just published this week in *Nature Medicine*, sponsored by Google, is eye-catching, proving that AI can best radiologists in screening interpretation for lung cancer when no previous imaging is available[25].
- **Genomics.** The discovery of the human genome-wide sequence has ushered a new era in medicine and enhanced our diagnostic capabilities. Some of them include:
  - Prenatal screening. Maternal blood is tested for fetal disorders.
  - Diagnosis using next-generation sequencing testing. This works for rare genetic disorders.
  - A new tumor classification relying on gene expression analysis. The practical application is pinpoint, targeted drug treatment[26, 27].

Genomics resides at the frontiers of medicine. As such, it offers great promises as seen above and also straddles potentially explosive issues, cloning being one of them. There is fear of reviving eugenics, a reviled experimentation made famous by Nazi Germany but with widespread practice[28].

As alluded to above, intervention for improving health care delivery needs not rely on expensive high-tech solutions. For a country like ours where infectious diseases are so prevalent, search for low-cost treatment ought to be a matter of existential importance. Some claims of success that worth mentioning:

- TB-LAM. Rapid urine test for TB in HIV positive patients. It has good specificity but low sensitivity but costs $3.50[29, 30]. Its exact role is yet to be defined but it is a step in the right direction for rapid, low-cost diagnosis not relying on expensive equipment.
- Widespread use of HPV vaccine in boys and girls from age 12 to 15 has caused a reduction of HPV-induced cervical cancer by 77 %[31]. Again in Haiti, cervical cancer is prevalent and has the highest rate of mortality in the world.[32] This experience from Australia is interesting and may offer a simple solution to a significant public health matter. Its purported success rate makes it a cost-effective way of trying to solve a serious crisis in our homeland.

The role of technology in improving health care is essential. The question should never be if but how and what with the proviso that there needs to be strict regulation and monitoring. The use should not be blind, for it can be harmful, but a careful choice based on risk/benefit weighing strongly, but not marginally, in the benefit direction and reasonable cost. In the instances where cost is prohibitive, there are available means that ought to be looked into to leverage negotiations for far lower cost. There are sources that should always be investigated to find ready-made, practical solutions that make all the difference. ◘

REFERENCES

1. Pasteur, L. Summary Report of the Experiments Conducted at Pouilly-le-Fort, Near Melun, on the Anthrax Vaccination. Retrieved from *Yale Journal of Biology And Medicine* 75 (2002), pp. 59-62.

2. Ligon BL. Sir Alexander Fleming: Scottish researcher who discovered penicillin. *Semin Pediatr Infect Dis.* 2004 Jan;15(1):58-64.

3. Kraemer, S.A., Ramachandran, A. Antibiotic Pollution in the Environment: From Microbial Ecology to Public Policy. *Microorganisms.* 2019; 7(6):180

4. Lange, C, Chesov, D, Heyckendorf, J, Leung, CC, Udwadia, Z, Dheda, K. Drug-resistant tuberculosis: An update on disease burden, diagnosis and treatment. *Respirology*. 2018; 23: 656– 673.

5. Melamed, A. Survival after Minimally Invasive Radical Hysterectomy for Early-Stage Cervical Cancer. *N Engl J Med*. 2018 Nov 15;379(20):1905-1914.

6. Ramirez, PT. Minimally Invasive versus Abdominal Radical Hysterectomy for Cervical Cancer. *N Engl J Med.* **2018 Nov** 15;379(20):1895-1904.

7. René Préval de nouveau à Cuba. *Le Nouvelliste*, December 27, 2006. http://lenouvelliste.com. Accessed July 3, 2019.

8. L'ancien dictateur d'Haïti Jean-Claude Duvalier est mort. *Le Monde*, October 4, 2014. http://www.lemonde.com. Accessed July 3, 2019.

9. Topol, E., Verghese, A. On what AI Means for the Physical Exam. Medicine and the Machine. *Medscape Podcast*, 7-3-19.

10. Eisner F, Hermann D, Bajaeifer K, Glatzle J, Königsrainer A, Küper MA. Gastric Ulcer Complications after the Introduction of Proton Pump Inhibitors into Clinical Routine: 20-Year Experience. *Visc Med*. 2017 Jun;33(3):221-226.

11. Kuna L, Jakab J, Smolic R, Raguz-Lucic N, Vcev A, Smolic M. Peptic Ulcer Disease: A Brief Review of Conventional Therapy and Herbal Treatment Options. *J Clin Med*. 2019;8(2):179. Published 2019 Feb 3.

12. Tareen, T. Association of Gastric Acid Suppression With Recurrent C. Difficile Infection. *JAMA Internal Medicine*. 2017 Jun; 177(6); 784-791.

13. Dos Santos-Schaller. Recurrence and death after Clostridium difficile infection: gender dependent influence of PPI therapy. *Springerplus*. 2016; 5:430.

14. Azab M, Doo L, Doo DH, et al. Comparison of the Hospital-Acquired *Clostridium difficile* Infection Risk of Using Proton Pump Inhibitors versus Histamine-2 Receptor Antagonists for Prophylaxis and Treatment of Stress Ulcers: A Systematic Review and Meta-Analysis. *Gut Liver*. 2017;11(6):781–788.

15. Paul Starr. A New Strategy for Health Care. *The American Prospect*, January 4, 2018. http://www.americanprospect.com. Accessed July 4, 2019.

16. Gerard F. Anderson et al.It's the Prices, Stupid: Why The US Is So Different From Other Countries. *Health Affairs*. May/June 2003. http://www.healthaffairs.org. Accessed July 4, 2019.

17. Cathleen London, MD, personnal communication.

18. Luthra, S. How to Fight a Soaring Drug Price: Innovate. *NY Times*, Feb 28, 2017. http://www.nytimes.com Accessed May 14, 2019.

19. http://www.who.int/medical_devices/diagnostics/Selection_in-vitro_diagnostics.

20. Progress Toward Rebuilding Haiti's Health System. http://www.cdc.gov.

21. http://www.who.int/medicines.

22. Herper, M., MD Anderson Benches IBM Watson in Setback for Artificial Intelligence in Medicine, *Forbes*. 2017. http://www.forbes.com. Accessed May 10, 2019.

23. Patel, N.M., et al., Enhancing Next-Generation Sequencing-Guided Cancer Care Through Cognitive Computing. *Oncologist*, 2018. 23(2): pp. 179-185.

24. Topol, Eric. Deep Medicine. How AI Can Make Healthcare Human Again. Basic Books, released 2019-03-12.

25. Ardila, D., et al. End-to-end lung cancer sreening with three-dimensional deep learning on low-dose chest computed tography. *Nature Medicine*, 2019. https: //doi.org/10.1038/s41591-019-0447-x

26. Raby, B. Principles of molecular genetics. UptoDate.

27. https://learn.genetics.utah.edu/content/basics/.

28. Webster, C,. Eugenic sterilization: Europe's shame. *Health Matters* issue 31 Winter 97/98.

29. Lawn SD, Gupta-Wright A. Detection of lipoarabinomannan (LAM) in urine is indicative of disseminated TB with renal involvement in patients living with HIV and advanced immunodeficiency: evidence and implications. *Trans R Soc Trop Med Hyg*. 2016;110(3):180–185.

30. Drain, P. K. *et al*. Rapid Urine LAM Testing Improves Diagnosis of Expectorated Smear-Negative Pulmonary Tuberculosis in an HIV-endemic Region. *Sci. Rep.* 6, 19992

31. Hall, M. The projected timeframe until cervical cancer elimination in Australia: a modelling study. *The Lancet Public Health*. October 2, 2018.

32. Giere, J. Cervical Cancer in Haiti and Hôpital Sacré-Coeur. http://www.crudem.org. Accessed July 4, 2019.

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