Under the Obama administration, United States health care may be poised for fundamental structural changes resulting in more insured Americans while controlling health care costs. Artificial intelligence (AI), telemedicine, and robotics will likely play a significant role in future United States health care. For example, these technologies could allow a relatively fixed number of physicians to provide health care to more patients.

Although the Obama administration has placed a great emphasis on health information technology (HIT), federal funding for HIT formally began with the final budget of the George W. Bush administration, which included the Distance Learning, Telemedicine, and Broadband Program. The American Recovery and Reinvestment Act of 2009 represents the current administration’s largest effort to promote additional progress. The Act established the Office of the National Coordinator for Health Information Technology, and appropriated billions of dollars for the development of an electronic health record infrastructure. Although the federal government has yet to significantly invest in medical robotics, the National Institutes of Health does maintain a medical robotics program. Advancements in these HIT systems are intended to address the needs of both patients and physicians.

Physicians need access to specific patient diagnostic and therapeutic information; and ideally this information should be available to the physician at the point of patient contact, probably in the form of electronic health records and medical references for physicians, so that health care can be planned and implemented in a timely fashion. AI could help physicians effectively process electronic health records, for instance by implementing clinical guidelines and by monitoring drug interactions.

Patient access to physicians can be limited by financial considerations and physician specialty. Financial considerations are important, but physician specialty access is also important, because most physicians become narrowly specialized over their career to manage certain disease states. Telemedicine is already ameliorating this problem. Telemedicine is the remote diagnosis and treatment of patients by means of telecommunications technology, and President Obama supports expanding the telemedicine infrastructure. The current telemedicine

Artificial Intelligence, Telemedicine, and Robotics in Health Care

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infrastructure is largely uncoordinated. The HIT programs could be used efficiently in the telemedicine context. The creation of a national electronic health record database would allow for a greater expansion of telemedicine by establishing consistent protocols.20

One example of telemedicine is rapid response to stroke,17 which is a medical emergency potentially treatable by thrombolytic (i.e., “clot buster” medication) or other interventions, if applied in a timely fashion.18 However, the diagnosis and treatment of stroke requires clinical skills that may not be available in rural areas and small communities,19 despite being the standard of care for neurology specialists for more than a decade.20

Enter telestroke, which is a subcategory of telemedicine, to extend the distribution of stroke care.21 Since the late 1990s, Massachusetts General Hospital (MGH) (in conjunction with Brigham and Women’s Hospital) has been developing the Partners TeleStroke network to provide patients in communities advanced stroke care options.22 Similar networks are currently being organized around the country.23

The 2009 review article by Demaerschalk and the STARR Conivestigators describes telestroke.24 In the ideal situation, telestroke refers to live two-way audiovisual telecommunication using a package of hardware and software to facilitate diagnosis and treatment of acute stroke.25 Studies have shown that “remote examinations” of acute stroke patients are excellent.26 In the hub-and-spoke model of telestroke, the patient’s information (CT head, examination, blood work, etc.) is transmitted to the hub (i.e., primary stroke center) from the spoke (i.e., treating hospital) and there is collaboration between the hub and spoke centers to implement optimal evidence-based stroke care for the acute stroke patient.27 More acute stroke patients would be treated with this potentially effective thrombolytic therapy if there was a neurologist to provide telemedicine consultation.28 Physicians practicing without neurology and stroke team support are reluctant to perform thrombolysis because the treatment can cause hemorrhage into the head, leading to greater disability and even death.29

The telemedicine system developed for acute care management is also being adapted for chronic care conditions,30 which enable patients greater access to physicians matching their specific healthcare needs and may increase the likelihood that clinical practice guidelines will be followed for more patients.31

Robots are another technology that is becoming common place in surgery.32 Surgery robots, such as the da Vinci Surgical System,33 allow a surgeon to operate remotely. Detailed treatment of robots must await another article.

The HIT systems raise interesting legal questions. For example, where is the physician practicing medicine? Where the physician is located? Where the patient is located? United States nongovernment physicians are licensed through state medical boards to practice medicine only in the licensing state.34 Some states would require the physician to have a full medical license where the physician is located; others would also require the physician to have a full license where the patient is located; and still others would only require the physician to have a telemedicine license where the patient is located, to name some licensing options, which has obvious implications for licensing and medical malpractice jurisdiction issues.35 These fundamental issues need resolution, although some health-care professionals think the issues are already resolved.36 A full discussion of these issues is outside the scope of this article.

Chronic care in telemedicine will create an avalanche of digital information under President Obama’s electronic health record initiative.27 The statute of limitations on medical liability is often two years, so records will need to be kept at least that long; however, most physicians keep records for as long as they are treating a patient, which may be many years and visits. And, what about patient modesty issues for recording some examination components?38

Remote robotic surgery has been termed cybersurgery, and with it comes many of the same licensing and record keeping issues that all telemedicine will have in the electronic health record era.39 Medical device, and presumably telecommunications, companies will become parties to medical-related negligence lawsuits.40

Another concern is the patient-physician relationship. As in many professions, there is an old teaching that physician success is based on affability, availability, and ability, in order of importance. Telemedicine and other AI and robotic advances—like improved medication mixers, patient simulators, and drug interaction information systems—will increase physician availability and ability to provide high quality health care. However, these advances may reduce physician’s perceived affability, with significant implications for the patient-physician relationship, and further implications for medical malpractice liability exposure.41

Endnotes


3. www.census.gov/prod/2008pubs/p60-235.pdf (255,000,000 Americans have health care insurance, with 45,000,000 uninsured). www.mahealthconnector.org/portal/site/connector/and www.massmed.org/AM/Template.cfm?Section=vs_currenttop&CONTENTID=22588&TEMPLATE=CM/ContentDisplay.cfm. (The sudden increase of insured residents swamped Massachusetts medical systems after passage of the Commonwealth’s landmark legislation in 2006. Something very similar may occur in the United States, as a whole. Artificial intelligence, telemedicine, and robotics, as physician
enhancers and extenders, may help alleviate some of the “manpower” shortage problems.

4. http://www.fastgate5.access.gpo.gov/cgi-bin/TXTCate.cgi?WAILocID=623415120
920+9+1+6&WAIAction=retrieve.


6. The American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, at 230–234. (The purpose of the Office of the National Coordinator (ONC) is to develop “a nationwide health information technology infrastructure that allows for the electronic use and exchange of information.” The ONC is also instructed to coordinate other health information technology policy recommendations, such as those concerning telemedicine, with other branches of the Department of Health and Human Services.)

7. The American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, at 467–496. (The Obama Administration claims $19 billion are being invested in computerized health records. Approximately $2 billion is given to the ONC, whose duties include nonelectronic health record business. See http://healthit.hhs.gov. The other $17 billion, or almost 90 percent of the investment, is for “incentive payments by Medicare and Medicaid to qualified providers for making meaningful use of electronic health records (EHR) in their practices”. See also www.whitehouse.gov/issues/health-care; http://ncrecovery.gov/library/pdf/Guidebook/Section19-SpecialFundingInitiatives.pdf.


9. www.informationweek.com/news/healthcare/showArticle.jhtml?articleID= 212800199. (However, President George W. Bush made a similar push. Funding electronic health records (EHRs) is a big obstacle, as to date, small medical practices have been exempted from EHR requirements due to high initial costs of establishing computer workstations at every patient-physician contact location, etc.) See also http://ecpi.loc.gov/cgi-bin/cpquery/?&sid= cp111KGP4&ftref=&nr-href=011611&db_id=111&item=&&s=TOC_2312685&;www.virc.research.va.gov/DataSourcesName/VISTA/VISTA.htm. (In addition, there are hardware and software compatibility issues. However, Veterans Health Information Systems and Technology Architecture, VistA, is an integrated system of software applications that directly supports patient care at Veterans Health Administration (VHA) health-care facilities.)

10. See www.epocrates.com (mobile device health-care information provider) and www.cochrane.org. (The Cochrane Collaboration, an international not-for-profit organization, providing up-to-date information about the effects of health care.)

11. www.ncbi.nlm.nih.gov/pmc/articles/PMC1839541/ (“Clinical guidelines represent the current understanding of the best clinical practice, and are now one of the most central areas of research in Artificial Intelligence (AI) in medicine and in medical decision making.”) ONC is requiring that EHR systems “implement five clinical support rules relevant to specialty or high clinical priority” to qualify for federal funds, p. 32 of www.federalregister.gov/OFRUpload/OFRData/2009-31217_PL.pdf.


13. www.ncbi.nlm.nih.gov/pmc/articles/PMC1071163. (See “Provider Shortages in Rural America.”)

14. www.abs.org/News_and_Events/news_archive/release_ABMS_Study_06_07.aspx. (“More than 90 percent of U.S. licensed physicians are ABMS Member Board certified. The ABMS certification is widely recognized by physicians, healthcare institutions, insurers and patients as the gold standard for judging a physician’s knowledge, experience and skills for providing quality healthcare within a medical specialty.”)

15. http://my.barackobama.com/page/content/uralplan/ (“Obama will strengthen the VA’s telemedicine infrastructure to expand the delivery of high quality healthcare to veterans residing in rural communities,” and “Obama supports increasing access to care in rural areas by promoting the wider adoption of effective telecommunications and health information technologies. He will invest $10 billion a year over the next five years to move the U.S. health care system to broad adoption of standards-based electronic health information systems”); see also www.thedead.com/corporatedeal maker/2009/07/cisco_and_unitedhealth_team on.php (“Telemedicine is a pillar of President Obama’s healthcare system overhaul.”)

16. www.ncbi.nlm.nih.gov/pmc/articles/PMCID1071163/. (See “Possible Solutions to the Problem of Inequities in Rural Health.”)


25. Id. at 53–54.

26. Id. at 54.

27. Id. at 55.

28. Id. at 56.

29. J.M. Wardlaw et al., “Thrombolysis for acute ischaemic stroke,” Cochrane Database Syst. Rev. 2009 Oct. 7 (4):CD000213. (“This overall benefit was apparent despite an increase both in deaths (evident at seven to 10 days and at final follow up) and in symptomatic intracranial hemorrhages.”)

30. See www.intouchhealth.com/products/robotics.html. (The InTouch Health System...
flagship product is the RP-7®, a mobile robotic platform that enables the physician to be remotely present.)


35. Id. at 77–79.

36. www.ncbi.nlm.nih.gov/pmc/articles/PMC2664571/. Bart M. Demaerschalk and STARR Coinvestigators, Stroke Telemedicine, 84(1) Mayo Clin. Proc. 53, 57 (2009). (“Given that telemedicine practice is not new, the ethical and malpractice aspects have largely been confronted and resolved,” see citations 24 and 25). However, “questions of jurisdiction and registration have yet to be answered definitively” per citation 23; and “There appear to be four main areas of concern: the doctor-patient relationship; malpractice and cross-border licensure; standards; and reimbursement. The lack of generally agreed interstate and international standards of law and ethics means that telemedicine and e-medicine will continue to struggle to gain widespread support” per citation 24 (emphasis added).

37. http://money.cnn.com/2009/01/12/technology/stimulus_health_news/ (“President-elect Barack Obama, as part of the effort to revive the economy, has proposed a massive effort to modernize healthcare by making all health records standardized and electronic.”)

38. www.hhs.gov/ocr/privacy/. (The Health Insurance Portability and Accountability Act of 1996 (HIPPA Privacy Rule does not address modesty issues, such as videography for pelvic examinations. And it is not clear that amending the act would be the right approach.)

39. T. McLean et al., Have a Surgical Robot, Why Not Provide Cybersurgery? 5(2) Expert Rev. Med. Devices 103 (2008). (“In order of importance, three reasons that appear to be hindering the market growth of cybersurgery are: an uncertain legal environment, money and communication skills.”) and T. McLean, The Complexity of Litigation Associated With Robotic Surgery and Cybersurgery, Int’l J. Med. Robotics and Computer Assisted Surgery 1 at 23 (2007). (“Ligation after cybersurgery, i.e., remote robotic surgery, will be complex. In addition to being able to sue physicians and hospitals, patients who sustain an adverse outcome after cybersurgery will have the potential to sue the robotic manufacturer and the telecommunication company.”)

40. Mracek v. Bryn Mawr Hospital et al., 2009 WL 637380 (E.D. Pa.). (Mracek brought this action against Bryn Mawr Hospital and Intuitive Surgical, Inc. for damages arising out of strict product liability, strict malpractice liability, negligence, and breach of warranty in connection with a prostatectomy performed with an operative robot called the “da Vinci” that was manufactured by Intuitive. A Motion for Summary Judgment filed by Intuitive is granted with regard to all causes of action.)
