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TELEMEDICINE: LESSONS FOR—AND FROM—EMERGING TECHNOLOGY POLICY

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CONTENTS

INTRODUCTION

In *Star Trek IV: The Voyage Home*, Dr. Leonard H. "Bones" McCoy is transported from the future to the present, where he encounters a woman in a hospital who tells him she needs "kidney—dialysis." Aghast, the doctor hands her a pill, remarking, "Dialysis! My God, what is this, the Dark Ages?"

Such futuristic 80's fiction has come to closely resemble reality, as today's healthcare advances so rapidly that even treatments from just a few years ago can look archaic. Yet, in one respect, the practice of medicine has not changed much since the medieval world: Doctors and patients must still, in general, see each other face to face.

However, as new technologies under the category of "telemedicine" have become more and more popular, the in-person nature of healthcare delivery is also starting to change. These technologies enable doctors to practice medicine at a distance (*tele-*)[1] using communications technologies from the simplest telephone calls to the most advanced remote Internet systems.

Telemedicine has obvious benefits—no more driving, no more waiting room delays, expanded access, synergies with technology—but it has also run into a number of policy and regulatory questions. These are already addressed in extensive literature on telemedicine policy and the objective of this paper is not to repeat those analyses. Rather, the present study looks at telemedicine from the lens of the general field of emerging technologies (such as automated vehicles, artificial intelligence and robotics) because in at least several key respects, the related policy issues are very similar.

In so doing, this paper first reviews the nature of telemedicine in history and today, and in particular, contemporary uses for telemedicine and possible future directions. It then considers several policy questions that have been raised with regard to telemedicine and compares those questions to similar issues with respect to other emerging technologies. And finally, the paper concludes by highlighting several ways in which experiences with telemedicine, as well as these other technologies, can inform policymakers with respect to emerging technologies more generally going forward.

BACKGROUND ON TELEMEDICINE

"Telemedicine" may generally be defined as the delivery of healthcare over a distance, such that the doctor is not in the same physical place as the patient.[2] In many cases, the doctor–patient interaction is still in real time, and thus the two can still hear and possibly even see each other.[3] A second possibility is called a "store and forward" interaction, in which case-relevant patient information is saved and delivered to a

1. The prefix "tele" is derived from the Greek "tēle," which means "far off."

2. See, e.g., Douglas A. Perednia and Ace Allen, "Telemedicine Technology and Clinical Applications," *Journal of the American Medical Association* 273:6 (1995), p. 483. https://www.researchgate.net/publication/15362592_Telemedicine_Technology_and_Clinical_Applications.

3. See, e.g., "Telemedicine: Opportunities and Developments in Member States: Report on the Second Global Survey on eHealth 2009," World Health Organization, 2010, p. 10 [hereinafter World Health Organization]. http://www.who.int/goe/publications/ehealth_series_vol2/en.

doctor for later evaluation and diagnosis.[4] This latter practice is common, for example, in radiology, where an X-ray or other body scan is captured and sent to a radiologist for review.[5]

For a technology that many may think of as new, telemedicine actually has a long and storied history. For early examples, at least one commentator points to bonfire signaling used in medieval Europe during the Black Plague and telegraphs during the Civil War.[6] Telephones have been used in early forms of telemedicine, for example, to transmit stethoscope sounds or electrocardiograph heart monitoring information.[7] Most commentators agree that modern telemedicine originated in the 1960s, both because of the introduction of television and because of the nascent manned-space-flight program.[8] Today, telemedicine uses Internet communications and other information technologies in the place of two-way televisions and radios.[9]

Key beneficiaries of telemedicine have included communities that traditionally lack physical access to hospitals or doctors.[10] Rural communities are a classic example and they have motivated widespread interest in deployment of telemedicine services.[11] Prison inmates are a second population where telemedicine has been effective.[12] Additionally, it has been used successfully in urban areas to allow children to see their primary care physician while at school, thereby avoiding absences.[13]

Unsurprisingly, telemedicine has not escaped the smartphone boom. Several services exist now where a patient can live chat or video conference with a doctor via a phone app.[14] These services are obviously helpful in reducing wait times and travel costs, but they also potentially promise better healthcare because they make specialty physicians accessible to a larger audience of patients not limited by geography.[15]

Although remote visitation telemedicine is now fairly well established, the future holds more potential to apply information technology breakthroughs to telemedicine. New devices (or creative uses of existing ones) can provide doctors with better monitoring capabilities and diagnostic information.[16] Artificial intelligence may also assist or supplant doctors in diagnoses in the future. For example, significant work has been done in the field of teledermatology to automatically identify conditions such as skin cancer using automated machine learning algorithms.[17] A system for diagnosing diabetic retinopathy, a common cause of blindness, has reached performance levels that equal that of a highly trained ophthalmologist.[18] Research into mental health status detection based on social media may also make its way into telemedicine.[19] Thus, although it is not a new technology, telemedicine is not a mature one either, and there is far more development to be done.

For this reason, as a case study for emerging technology policy, telemedicine is ideal in several respects. For starters, due to its status as an older technology, many of the policy questions have already been fleshed out. At the same time, its entanglement with the undoubtedly complex healthcare system means that adoption has been slow and incremental, which is largely the reason that policy debates continue today. Finally, the technology for telemedicine has stabilized

4. Ibid.

5. See, e.g., Solomon Batnitzky et al., "Teleradiology: An Assessment," *Radiology* 177:1 (1990), p. 11. https://www.ncbi.nlm.nih.gov/pubmed/2204957.

6. Karen M. Zundel, "Telemedicine: History, Applications, and Impact on Librarianship," *Bulletin of the Medical Library Association* 84:1 (1996), p. 72. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC226126.

7. John Craig and Victor Patterson, "Introduction to the Practice of Telemedicine," *Journal of Telemedicine and Telecare* 11:1 (2005), p. 5. https://www.researchgate.net/publication/7908096_Introduction_to_the_practice_of_telemedicine.

8. Ibid., pp. 5–6; and Rashid L. Bashshur and Patricia A. Armstrong, "Telemedicine: A New Mode for the Delivery of Health Care," *Inquiry* 13:3 (1976), pp. 235–36.

9. World Health Organization, p. 9. http://www.who.int/goe/publications/ehealth_series_vol2/en.

10. Marilyn J. Field, ed., "Telemedicine: A Guide to Assessing Telecommunications in Health Care," National Academy of Sciences, 1996, pp. 40–53. https://www.nap.edu/catalog/5296/telemedicine-a-guide-to-assessing-telecommunications-for-health-care.

11. See, e.g., Rick Schadelbauer, "Anticipating Economic Returns of Rural Telehealth," NTCA–The Rural Broadband Association, March 2017, pp. 9–10. https://www.ntca.org/sites/default/files/documents/2017-12/SRC_whitepaper_anticipatingeconomicreturns.pdf.

12. Debra Larsen et al., "Prison Telemedicine and Telehealth Utilization in the United States: State and Federal Perceptions of Benefits and Barriers," *Telemedicine Journal and e-Health* 10:S-2 (2004), p. 86. http://www.uapd.com/wp-content/uploads/Prison-Telemedicine-and-Telehealth-Utilization-in-the.pdf.

13. Kenneth McConnochie et al., "Integrating Telemedicine in Urban Pediatric Primary Care: Provider Perspectives and Performance," Telemedicine and e-Health 16:3 (2010), pp. 280–81. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2993055; Kenneth M. McConnochie et al., "Telemedicine Reduces Absence Resulting From Illness in Urban Child Care: Evaluation of an Innovation," *Pediatrics* 115:5 (2005), p. 1281. https://www.researchgate.net/profile/Kenneth_Mcconnochie/publication/7871332_Telemedicine_Reduces_Absence_Resulting_From_Illness_in_Urban_Child_Care_Evaluation_of_an_Innovation.

14. Kavita Daswani, "Telehealth: Patient Care via Smartphone," *Los Angeles Times*, Nov. 7, 2015. http://www.latimes.com/health/la-he-heal-side-20151107-story.html.

15. Joseph Kvedar et al., "Connected Health: A Review of Technologies and Strategies to Improve Patient Care with Telemedicine and Telehealth," *Health Affairs* 33:2 (2014), p. 196. https://www.healthaffairs.org/doi/pdf/10.1377/hlthaff.2013.0992.

16. See, e.g., Melissa Locker, "Researchers Create Tech that Turns Your Smartphone into a Medical Diagnostic Tool," *Fast Company*, Aug. 15, 2017. https://www.fastcompany.com/40453197/researchers-create-tech-that-turns-your-smartphone-into-a-medical-diagnostic-tool.

17. Andre Esteva et al., "Dermatologist-Level Classification of Skin Cancer with Deep Neural Networks," *Nature* 542:7639 (2017), p. 115. https://cs.stanford.edu/people/esteva/nature/; and Susan Scutti, "AI System Detects Skin Cancer with Expert Accuracy," CNN, Jan. 26, 2017. https://www.cnn.com/2017/01/26/health/ai-system-detects-skin-cancer-study/index.html.

18. Varun Gulshan et al., "Development and Validation of a Deep Learning Algorithm for Detection of Diabetic Retinopathy in Retinal Fundus Photographs," *Journal of the American Medical Association* 316:22 (2016), p. 2402. https://jamanetwork.com/journals/jama/fullarticle/2588763; Will Knight, "An AI Ophthalmologist Shows How Machine Learning May Transform Medicine," *MIT Technology Review*, Nov. 29, 2016. https://www.technologyreview.com/s/602958/an-ai-ophthalmologist-shows-how-machine-learning-may-transform-medicine.

19. Joseph Simpson, "How Machine Learning and Social Media Are Expanding Access to Mental Health," *Georgetown Law Technology Review* 2:1 (2017), pp. 144–45. https://www.georgetownlawtechreview.org/how-machine-learning-and-social-media-are-expanding-access-to-mental-health/GLTR-12-2017.

in some respects but not in others, which offers some opportunity to evaluate the correctness of earlier policy predictions but still leaves many future questions to explore.

EMERGING TECHNOLOGY POLICY ISSUES

With respect to policy issues, experiences with telemedicine reflect the following themes that are common across many emerging technologies:

Market Distortions from Prior Sunk Costs

A common theme for emerging technologies is that existing sunk costs into older business models cause market distortions or other incentive issues that delay entry of new technology. The development of ridesharing apps, for example, was delayed by the fact that taxi drivers had sunk costs in expensive taxi medallions.[20] This problem comes up for telemedicine in a remarkably intricate form that is related to insurance reimbursement.

In particular, a key telemedicine policy question has been "reimbursement parity"; or, whether health insurance providers should be required to pay for telemedicine services at the same rates as they pay for equivalent in-person ones.[21] According to a 2016 report, there are at least 32 states that require parity in insurance reimbursements between telemedicine and traditional visits.[22] At first glance, reimbursement parity seems odd. After all, without brick and mortar establishments and their associated staff requirements, for example, telemedicine services ought to be cheaper to provide and one might expect insurance reimbursements to reflect that cost savings. While it is true that for doctors, the cost savings of telemedicine are largely in overhead, a telemedicine visit demands just as much time as a regular office visit and indeed the telemedicine visit requires the doctor to pay the additional cost of new computers and communications services. As one study reported, "Providers perceived little or no efficiency or effectiveness advantage to their practice in using telemedicine as a process to deliver care."[23] As a result, currently, a doctor would have to charge at least as much for telemedicine visits as for traditional ones.

This might be fine in an ordinary market, as patients may be willing to pay more for the convenience of telemedicine, particularly as traditional consultations can cost patients substantial driving time, lost wages and other expenses.[24] But because doctor visits are paid through insurance rather than out of pocket, patients do not necessarily choose with their wallet which service they would prefer. On the other hand, insurance providers are more likely to be motivated by their risk aversion to untested services such as telemedicine and accordingly may want to reimburse less for those services. The result is a stalemate in price negotiation between doctors and insurance providers and thus telemedicine services are not offered.

For these reasons, a straight free-market strategy may not work in the case of telemedicine. However, reimbursement parity is only one approach to breaking the impasse that results from sunk costs. There are other approaches that may perhaps be better suited, such as altering copays for insured patients.[25] Most importantly, the need for market interference strategies like reimbursement parity will likely disappear as market participants adapt to the changing field. For example, as telemedicine becomes more popular, doctors will likely stop renting expensive offices or hiring as many staff, thereby allowing cost savings to enter the system.

In many cases—not only with respect to telemedicine but also to other emerging technologies—the effect of incumbents' sunk costs is that they seek regulatory barriers to block or delay adoption of the new technology.[26] In those common cases, the correct response is to call for a free-market approach that allows the new technology to compete on level ground with incumbents. But as the insurance parity issue shows, it can sometimes be the case that existing market structures themselves are a barrier to competition. In these cases, state intervention on a temporary basis may be necessary to level the playing field.

Decentralized Points of Regulation

Many emerging technologies face a complex—and often unrelated—web of regulatory authorities that could otherwise prevent those technologies from growing. Telemedicine both exemplifies this regulatory web and illustrates a partial effort to overcome it.

Telemedicine implicates several different federal agencies. The U.S. Food and Drug Administration has authority to test and approve medical devices and telemedicine equipment

20. Zach Graves et al., "Beyond Legal Operation: The Next Ridesharing Policy Challenges," *R Street Policy Study* No. 134, March 2018, p. 4. http://www.rstreet.org/policy-study/beyond-legal-operation-the-next-ridesharing-policy-challenges.

21. Tony Yang, "Telehealth Parity Laws," Robert Wood Johnson Foundation, Aug. 15, 2016, pp. 3–4. https://www.healthaffairs.org/do/10.1377/hpb20160815.244795/full.

22. Ibid., p. 3.

23. McConnochie et al., p. 287. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2993055.

24. Navjit W. Dullet et al., "Impact of a University-Based Outpatient Telemedicine Program on Time Savings, Travel Costs, and Environmental Pollutants," *Value in Health* 20:4 (2017), p. 544. https://doi.org/10.1016/j.jval.2017.01.014.

25. See, e.g., "Exempting In-Home Video Telehealth From Copayments," 77 Fed. Reg. 13195 (Dept. of Veterans Affairs, Mar. 6, 2012). https://www.federalregister.gov/documents/2012/03/06/2012-5354/exempting-in-home-video-telehealth-from-copayments.

26. Zach Graves, "Optometrists Push For State Laws Blocking Online Eye Exams," *Techdirt*, April 19, 2016. https://www.techdirt.com/articles/20160412/17332734166/optometrists-push-state-laws-blocking-online-eye-exams.shtml.

can fall within that approval authority.[27] Federal healthcare programs also have influence over the development of telemedicine: Medicare and Medicaid specify which services are and are not reimbursable, which can drive the development of telemedicine in some fields but not in others.[28] The Federal Communications Commission has also been involved by offering certain subsidies to encourage deployment of telemedicine communication systems.[29]

The scope of regulatory authority—even decisions not to regulate—can have major consequences for emerging technologies, as demonstrated by telemedicine. The FDA has generally relinquished its regulatory authority over any "general wellness product," a regulatory carve-out now formalized in the recently enacted 21st Century CURES Act.[30] This has arguably led to a blooming market in general fitness apps and devices, potentially to the detriment of systems that deal with more serious or important diagnostic matters.

State authorities also play a role in telemedicine adoption. Doctors are generally licensed on a per-state basis, so a doctor licensed in one state generally cannot practice in another.[31] This is of little consequence when the practice of medicine is conducted in person, but when telemedicine enables a doctor to see patients across the country (or even around the world), state-by-state licensing becomes a serious hindrance.

Further, in view of this new technology, states have adopted laws and policies to alter their own licensing regimes. For example, the Interstate Medical Licensure Compact, joined by 22 states as of 2017, standardizes and expedites pathways to cross-state medical licensing. Indeed, the Compact was formed in 2013 with the specific aim of increasing the adoption of telemedicine.[32] The Compact thus represents at least a partial solution to the problem of multiple regulatory authorities bogging down adoption of a new technology. State licensing nevertheless continues to hinder telemedicine adoption: a recent paper describes "the requirement that physicians obtain licenses" from multiple states as "[t]he main barrier to telemedicine."[33] The key point here is that it is the multiplicity of regulatory regimes that slows technology adoption. The policy solutions proposed in that paper (aside from the elimination of medical licensing, which the paper concedes is "not currently feasible"[34]) focus on limiting the number of regulatory agencies that affect each telemedicine practitioner, either by rendering the practitioner's home state the sole relevant licensing agency or by federalizing medical licensing.[35]

The goal of consolidating regulatory power over a particular field is shared with other emerging technologies, which shows that telemedicine is not unique in this respect. For example, in the field of highly autonomous vehicles, there has been an ongoing tug-of-war between federal and state authorities as to regulatory power as the field emerges.[36] And just as multiplicity in medical licensing authority may impede telemedicine, multiple regulators of highly automated vehicles can present a substantial barrier to deployment.[37] Proposed legislative solutions to preempt state regulations regarding highly automated vehicles[38] thus may inform proposals for reforming medical licensing, and vice versa.

Regulation Untailored to Future Developments

Another lesson of the state licensing issue with regard to telemedicine is that existing regulatory structures are often unsuitable in view of technological developments. Frequently, this is because those structures were built upon assumptions that the new technology eventually proves incorrect. In the case of medical licensing, for example, the assumption was that doctors saw patients in person and so it would be uncommon for a doctor to need licenses in multiple states. However, telemedicine technology made that previously uncommon occurrence a far more common one.

A second example of untailored regulation facing off with new technology is in the area of medical records privacy. Currently, privacy of medical information is generally governed by a rule issued by the Department of Health and Human Services pursuant to the Health Insurance Porta-

27. 21 U.S.C. § 360c. https://www.law.cornell.edu/uscode/text/21/360c; Peter S. Reichertz and Naomi Joy Levan Halpern, "FDA Regulation of Telemedicine Devices," *Food and Drug Law Journal* 52:4 (1997), p. 517.

28. Yang, p. 3. https://www.healthaffairs.org/do/10.1377/hpb20160815.244795/full.

29. "Promoting Telehealth in Rural America," 83 Fed. Reg. 303 (Fed. Communications Commission, Jan. 3, 2018).

30. "General Wellness: Policy for Low Risk Devices: Guidance for Industry and Food and Drug Administration Staff," Food and Drug Administration, July 29, 2016, p. 2. https://www.fda.gov/downloads/medicaldevices/deviceregulationandguidance/guidancedocuments/ucm429674.pdf; 21st Century Cures Act, Pub. L. No. 114-255, sec. 3060, § 520(o)(1)(B), 130 Stat. 1033 (2016). https://www.congress.gov/bill/114th-congress/house-bill/34/text.

31. See, e.g., Stacey Swatek Huie, "Facilitating Telemedicine: Reconciling National Access with State Licensing Laws," *Hastings Communications and Entertainment Law Journal* 18:2 (1995), p. 395. https://repository.uchastings.edu/hastings_comm_ent_law_journal/vol18/iss2/5.

32. "Issue Brief: Interstate Medical Licensure Compact," American Medical Association, 2017. https://www.ama-assn.org/sites/default/files/media-browser/specialty group/arc/fsmb-interstate-medical-licensure-compact-issue-brief.pdf.

33. Shirley V. Svorny, "Liberating Telemedicine: Options to Eliminate the State-Licensing Roadblock," Cato Institute, Nov. 15, 2017, p. 2. https://www.cato.org/publications/policy-analysis/liberating-telemedicine-options-eliminate-state-licensing-roadblock.

34. Ibid., p. 7.

35. Ibid., pp. 7–9.

36. See, e.g., Ian Adams, "Self-driving cars are setting the stage for regulatory battle between feds and the states," *The Hill,* June 22, 2017. http://thehill.com/blogs/pundits-blog/technology/338909-self-driving-cars-are-setting-the-stage-for-regulatory-battle.

37. Ibid.

38. S. 1885, AV START Act, 115th Congress. https://www.congress.gov/bill/115th-congress/senate-bill/1885.

bility and Accountability Act of 1996 (HIPAA).[39] HIPAA has been described as "excessively and unnecessarily complex" and as actually targeted less toward privacy and more toward law enforcement access to medical records.[40] That is unsurprising given that the origins of the law date back to the 1970s when medical records would generally have been stored on paper.[41] Indeed, one unintended consequence of HIPAA today is that many medical records still are stored on paper, despite the wide availability of information technology for storing other sorts of records.[42]

Privacy rules for medical information are no doubt important, but they can be maladapted to advances in telemedicine. Much research is ongoing into using computer algorithms to assist doctors in diagnosing conditions through automated data analysis, as discussed above. However, the development of these machine learning systems depends on large quantities of training data and access to that training data may be restricted as a result of privacy rules such as HIPAA. This is not to say that privacy is inherently in conflict with machine learning technologies—data anonymization techniques can potentially allow for both privacy and data analysis—but it is to suggest that laws designed for pre-technology practices can end up inhibiting a post-technology world.

Data protection laws have conflicted with new technologies in areas other than telemedicine. Advances in artificial intelligence in all fields depend on availability of data that can be stymied by laws such as trade secrets and copyright, to the detriment of the technology's advancement.[43] Given that data protection issues in telemedicine are not dissimilar to those issues in other areas, there is good reason to believe that an appropriate privacy framework for telemedicine can be modeled on other privacy frameworks and authorities rather than to build a new one from scratch. This is, in part, why one commentator calls for the Federal Trade Commission rather than the Food and Drug Administration to be the single authority for telemedicine privacy.[44]

The "Perfect" Thwarts the "New"

A common question about telemedicine is whether it offers the same quality of service as traditional doctor visits. For example, some commentators have suggested that telemedicine may be inferior due to "indirect physical exam, difficult access to testing, and unclear follow-up."[45] Others question whether patients can receive adequate care without an ongoing doctor–patient relationship, insofar as telemedicine systems tend to gravitate toward pairing patients with the first-available doctor rather than one who has seen the patient before.[46]

Proponents and developers of telemedicine services have two responses to these concerns. The first is that telemedicine makes healthcare available to patients who otherwise might not have access at all. Indeed, rural patients far away from hospitals, inmates in prisons or bedridden patients without access to transit do not choose between telemedicine and in-person visits. Rather, they often choose between *tele*medicine and *no* medicine. For populations such as these, it makes little sense to say that telemedicine is an inferior option to traditional practice, since traditional practice is not an option.

The second response is that the empirical data does not bear out the proposed quality concerns. For example, a 2015 meta-study reviewed 35 telemedicine cost-effectiveness studies between 1998 and 2013 and concluded that: "[m]ost research studies in the literature have concluded that telemedicine systems are cost-effective."[47] Similarly, a randomized control trial in the United Kingdom found: "no major differences in clinical outcome between teledermatology and conventional outpatient dermatology care."[48]

39. 45 C.F.R. part 164.

40. George J. Annas, "HIPAA Regulations—A New Era of Medical-Record Privacy?", *New England Journal of Medicine* 348:15 (2003), p. 1486. https://www.mcmaster.ca/ors/ethics/ncehr/2003/apr2003/1486 NEJM HIPAA II.pdf.

41. Ibid.; and "Personal Privacy in an Information Society," Privacy Protection Study Commission, July 1977, pp. 277–317. https://www.ncjrs.gov/pdffiles1/Digitization/49602NCJRS.pdf.

42. Albert Boonstra and Manda Broekhuis, "Barriers to the Acceptance of Electronic Medical Records by Physicians from Systematic Review to Taxonomy and Interventions," *BMC Health Services Research* 10:231 (2010), p. 11. https://bmchealthservres.biomedcentral.com/articles/10.1186/1472-6963-10-231.

43. Amanda Levendowski, "How Copyright Law Can Fix Artificial Intelligence's Implicit Bias Problem," *Washington Law Review* (forthcoming 2018). https://ssrn.com/abstract=3024938; Taylor R. Moore, "Trade Secrets and Algorithms as Barriers to Social Justice," Center for Democracy and Technology, August 2017. https://cdt.org/files/2017/08/2017-07-31-Trade-Secret-Algorithms-as-Barriers-to-Social-Justice.pdf.

44. Joseph L. Hall and Deven McGraw, "For Telehealth to Succeed, Privacy and Security Risks Must Be Identified and Addressed," *Health Affairs* 33:2 (2014), p. 220. https://www.healthaffairs.org/doi/pdf/10.1377/hlthaff.2013.0997.

45. Lisa Rapaport, "Virtual Doctor Visits May Not Be Best for Urgent Care," Reuters, April 4, 2016 (quoting Dr. David Levine). https://www.reuters.com/article/us-health-virtualdoctors/virtual-doctor-visits-may-not-be-best-for-urgent-care-idUSKCN0X127G. Dr. Levine was commenting on a study that found "significant variation across companies" that offer telemedicine services, in diagnosing a standardized patient. See Adam J. Schoenfeld et al., "Variation in Quality of Urgent Health Care Provided During Commercial Virtual Visits," *JAMA Internal Medicine* 176:5 (2016), p. 642. https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/2511324. Notably, though, Dr. Levine published commentary to that same study that seemed to take a very different tack to that which was reported by Reuters. Specifically, he suggested that patients "might have fared similarly, better, or worse at their primary care physician's office or a retail clinic." See Jeffrey A. Linder and David M. Levine, "Health Care Communication Technology and Improved Access, Continuity, and Relationships: The Revolution Will Be Uberized," *JAMA Internal Medicine* 176:5 (2016), p. 643. https://jamanetwork.com/journals/jamainternalmedicine/article-abstract/2511321.

46. Edward Allan Miller, "The Technical and Interpersonal Aspects of Telemedicine: Effects on Doctor–Patient Communication," *Journal of Telemedicine and Telecare* 8:1 (2003), pp. 4–5. https://pdfs.semanticscholar.org/8674/213b6d79a8d432a8549bd26ab2698bc1142c.pdf.

47. Isabel de la Torre-Díez et al., "Cost-Utility and Cost-Effectiveness Studies of Telemedicine, Electronic, and Mobile Health Systems in the Literature: A Systematic Review," *Telemedicine and e-Health* 21:2 (2015), p. 84. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4312789.

48. R. Wooton et al., "Multicentre Randomised Control Trial Comparing Real Time Teledermatology with Conventional Outpatient Dermatological Care: Societal Cost-Benefit Analysis," *BMJ* 320:7244 (2000), p. 1255. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC27370.

In responding to criticisms, proponents of telemedicine may be comforted (or saddened) to know that they are not alone. Critics of many emerging technologies tend to demand perfection out of those technologies, even though the human analogues that they supplement or replace cannot be said to meet such high demands. For example, artificial intelligence algorithms are regularly criticized for displaying improper racial or gender biases, despite the fact that humans quantifiably display the same.[49] Highly autonomous vehicles are expected to make correct ethical judgments about how to handle car accident situations even though the same level of judgment would never be expected of human operators.[50] Certainly, it is reasonable to have high expectations for technological systems, but to the extent that those high expectations become reason for delaying innovation, the "perfect" becomes the enemy of the "new."

As an older emerging technology, telemedicine enjoys a solid platform of empirical evidence and experience that can overcome many of these theoretical criticisms. But there is a chicken-and-egg problem at work here. Empirical evidence and experience require the technology to exist and to be used. That is, if empirical evidence is the threshold requirement for adopting the technology in the first place, then neither the technology nor the evidence will come into being.

LESSONS FOR EMERGING TECHNOLOGY POLICY

Given that telemedicine policy shares many features with policy for other emerging technologies, experiences with telemedicine can help to inform their future steps, just as other technologies can reciprocate with respect to telemedicine. Accordingly, what follows are several key lessons that are drawn from the observations made in the previous sections.

Need must be highlighted early. Interest in telemedicine arose early because of a well-defined need: rural communities that lacked hospitals and doctors. Although those sorts of needs may not drive capital investment (there is likely not much money in serving rural communities), they do motivate policymakers to add flexibility to regulations so those communities can be served.

Conduct early empirical studies and facilitate early adoption. Quantitative studies of the benefits of a new technology are the key to widespread acceptance. But those studies require the technology to be in enough use in at least limited markets so that studies can be done.

Technology policy *is* data policy. Because telemedicine is an information technology, it implicates all the related policy questions, such as data privacy, cybersecurity and national data localization—to name a few. In many respects, the uniquely private nature of health information presents unique challenges for these data policy issues, which necessitates special health data rules, such as HIPAA. But in other respects, data is data and thus general frameworks for privacy or security may be workable for specific technologies like telemedicine. The cost savings and regulatory simplicity of a unified approach to data policy may ultimately outweigh any special concerns for particular types of data.

Government activity should be coordinated. When multiple regulatory bodies threaten to slow down the growth of a new technology, coordination among those bodies can help. Other forms of agency cooperation might also be explored. For example, in the context of telephone marketing, the Federal Trade Commission and Federal Communications Commissions have entered memoranda of understanding as to their respective jurisdictions in that area, thereby avoiding duplication of efforts.[51] Reduction of the number of agencies relevant to an emerging technology can help concentrate expertise, avoid conflicting rules and ultimately facilitate growth while preserving appropriate oversight.

Incentives of incumbent stakeholders should be considered. The tendency of those who have made investments in older business models that are likely to be disrupted by a new technology will be to impose barriers to its adoption. Policymakers must be attuned to the public choice theory concern that the interests of those incumbents may, in many cases, not align with the overall public good. Whether that militates in favor of a lighter-touch regulatory approach or specific intervention, as in the case of insurance parity, will be a case-specific determination that will require careful consideration of economic incentives.

Focus on potential benefits rather than just hypothetical fears. Overall, policymakers should seek to foster an environment of "permissionless innovation,"[52] in which new technologies are allowed to develop and problems are addressed as they arise, rather than clinging to a precautionary principle of keeping innovations off the market

49. Arthur Rizer and Caleb Watney, "Artificial Intelligence Can Make Our Jail System More Efficient, Equitable and Just," *Texas Review of Law and Politics* 2018 (forthcoming 2018), pp. 15–17. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3129576.

50. Nidhi Kalra and David G. Groves, "The Enemy of Good: Estimating the Cost of Waiting for Nearly Perfect Automated Vehicles," RAND Corporation, 2017, p. 3. https://www.rand.org/pubs/research_reports/RR2150.html.

51. Memorandum of Understanding from Federal Communications Commission and Federal Trade Commission (Nov. 16, 2015). http://transition.fcc.gov/Daily_Releases/Daily_Business/2015/db1116/DOC-336405A1.pdf; Memorandum of Understanding on Telemarketing Enforcement from Federal Trade Commission and Federal Communications Commission (2003) in "Annual Report to Congress for FY 2003 and 2004 Pursuant to the Do Not Call Implementation Act on Implementation of the National Do Not Call Registry," Federal Trade Commission, 2005. https://www.ftc.gov/sites/default/files/documents/reports/national-do-not-call-registry-annual-report-congress-fy-2003-and-fy-2004-pursuant-do-not-call/051004dncfy0304.pdf.

52. See Adam Thierer, *Permissionless Innovation: The Continuing Case for Comprehensive Technological Freedom* (Mercatus Center, 2016). http://permissionlessinnovation.org/wp-content/uploads/2016/03/Thierer_Permissionless_web.pdf.

until all potential shortcomings have been resolved. In several respects noted above, telemedicine demonstrates that hypothetical concerns—imperfect diagnoses, loss of personal relationships—are fixed as the technology evolves or become unimportant as the technology shifts public norms. By contrast, benefits are often unexpected and unpredictable—the value of telemedicine to prison inmates or schoolchildren, for example, are perhaps obvious in hindsight but certainly were not as clear before the technology became reasonably common. Telemedicine thus serves as a valuable data point that, in the long run, regulatory openness to new developments ultimately pays dividends.

CONCLUSION

Healthcare policy is complicated to the degree that many do not want to approach it and adding technology into the mix makes it only more unapproachable. However, this should not be the case. In many respects, telemedicine is simply another species of emerging technology and policy lessons across different emerging technologies can inform them all. And, as with other emerging technologies, the priority for policymakers should be to enable the benefits, not follow the fears. Experience with telemedicine thus far has largely not borne out the worst-case imagined scenarios, and there is little reason to believe that its next generation will be any different in this respect.

Especially over the last few decades, historical use of telemedicine offers valuable lessons for newer emerging technologies such as artificial intelligence and automated vehicles. At the same time, new developments in telemedicine, such as automated diagnoses and improved communication capabilities, will raise new policy challenges, the answers to which may be drawn from other technological fields. The rising tide of innovation will hopefully be a boon to all disciplines. If so, perhaps we will move closer to a day when a treatment like dialysis is relegated to the "Dark Ages" of medicine.

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