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# Clinical Physician Versus Data Scientist: Wearing Different Hats in Future Medicine

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Recent years have witnessed a boom in cutting-edge technologies. Accordingly, due to this unprecedented advancement, the intersection of healthcare and technology has led to the development of various innovative applications centered on data (1). Likewise, understanding data mining regarding patient care will become increasingly crucial as the medical field becomes more complex and encounters a lack of funds. Moreover, it is becoming increasingly difficult for academic institutions, private companies, insurance providers, and public health systems to keep up with the growing volume of health-related data, including prescriptions, clinical notes, data on pharmaceutical purchases, information about health insurance, details from medical investigations and laboratory results, and Electronic Health Records (EHR), every 12 - 14 months. The emergence of data mining techniques in the coming decade will transform conventional medical databases into knowledge-based, evidence-based healthcare, so clinical physicians should be aware of the potential of these techniques to enhance healthcare quality (2-4).

Data analytics can be utilized in a variety of areas in healthcare, including patient surveillance, protection of patients' privacy, healthcare administration, mental state and well-being, and drug safety. For instance, healthcare data warehouses and cloud storage are popular ways of storing vast quantities of electronic data in hospitals and clinics to improve healthcare outcomes at minimal cost and maximum security. In addition to its medical applications, data storage serves various non-medical purposes, such as research, education, evaluation, and more. For example, users can retrieve radiology results files from a repository using keywords that meet patient privacy policies (5). It is also possible to obtain vital information about the anatomy and function of organs from image processing of healthcare data and use this information to diagnose diseases and patient conditions. For example, the technology is currently used to delineate organs, detect lung cancer, and diagnose neurological and cardiovascular disorders. Therefore, screening, diagnosis, and prognosis could be more effective by using artificial intelligence for image processing in the medical field. Additionally, combining medical imaging with other types of data, such as genomic data, has increased accuracy and facilitated the early diagnosis of diseases (6). One example is precision medicine, which relies on extensive data analysis, such as radiomics and genomics, to tailor treatments instead of adopting a one-size-fits-all approach. Multiple medical domains, including radiation oncology, psychiatry, and infectious diseases, may also benefit from the structure of this framework (7-9).

On the other hand, data-driven applications are not limited to hospitals and clinics; for instance, telemonitoring systems, predictive models for personalized asthma attacks, and autonomous geriatric fall detection systems thrive outside the hospital (7, 8). In addition, there are also some health-based apps and the Internet of Things (IoT) devices regarding telemedicine. As an example, Apple and Google are developing wearable technology that will provide real-time, accurate monitoring of medical data (such as mood, diet, exercise, and sleep cycle patterns) that can be correlated with physiological markers (such as heart rate, calories burned, blood glucose level, and cortisol levels) (5).

Through IoT, patients can quickly and securely communicate health data with their physicians and healthcare providers and take charge of their treatment. As a result, individuals will be able to take responsibility for their health and actively participate in their treatment, which may result in fewer unnecessary hospitalizations. The Internet of Things is a group of networks, applications, and sensors that can share and collect data. A wide variety of devices, from smartwatches to autonomous vehicles to medical tools, fall under this category. Due to their capabilities, these instruments are expected to transform the delivery of medical care (10). "True Colors" is an example of a wearable gadget designed to collect patient-centered data that is accessible and acceptable enough to provide reliable longitudinal follow-up. In addition, this approach is undergoing testing to replace conventional daily health monitoring (5). Furthermore, electronic health records paved the way for big data research and brought data science to the patient's bedside (11, 12).

An excellent example of using data science in the healthcare system can be found in intensive care units (ICUs). However, a reductionist approach is insufficient to address the complexity of critical patients. For example, investigating a single therapeutic intervention or biomarker may not be adequate to meet the needs of intensive care units (13). Therefore, critical care management and research must adopt an interdisciplinary strategy that considers the complexity of critically ill patients and uses computational technologies and algorithms to meet this challenge.

In addition, massive amounts of the data required to execute this plan are presently being generated and digitized. For instance, emerging technologies, such as patient monitoring systems and electronic health records, generate mineable data. Multiomics also combines large volumes of data from the genome, proteome, transcriptome, and other "-omes" to provide a deluge of data. As a result, it can help biological discoveries on several levels. Therefore, physicians should be aware of the advantages and disadvantages of data science (14).

It is expected that in the future, doctors will immediately understand the patient's reason for making an appointment. In addition, physicians will learn about data abnormalities during annual health screenings. For example, they do not need to take the patient's daily temperature because they receive it from home. In addition, individuals frequently monitor and report their blood pressure to their physicians. Thus, possible therapies and their success rates are quickly addressed. Standard treatment is 95 percent successful, according to data obtained from people with proximate causes and physiologies. As a result, patients may depart the office after 10 minutes with this rapid, opinion-free diagnosis.

Furthermore, healthcare companies may lower their annual expenditures by more than 25 percent via big data analytics. Big data analytics has the potential to identify and predict diseases and may result in cost savings by reducing the frequency of unnecessary hospital readmissions. The healthcare industry needs more knowledge about the causes of readmissions to address the problem effectively. The capacity to precisely detect these connections would substantially assist healthcare practitioners in improving patient care processes and preventing needless readmissions. Staffing, surgical demand forecasts, patient care, and the effectiveness of the pharmaceutical supply chain may all benefit from the insights from big data analytics. These developments will eventually lead to a reduction in medical care expenditures by employers. Indeed, a physician with a background in mathematics and statistics can provide this data-driven treatment. Thus, even medical professionals have become data scientists in the digital world (15, 16).

Conclusions: The future of medicine will entail close collaboration between data science and physicians. Massive volumes of clinical, physiological, and "omics" data are processed by computational algorithms, giving physicians bedside, edible, interpretable, and actionable insights to improve their decision-making. Predictive models can provide suggestions for diagnosis and therapy, but it is the responsibility of physicians to provide context and coordinate their usage. As a result, false alarms are diminished, and systems are constantly improved via collaborative efforts and scientific rigor. However, our capacity to train new and experienced clinicians in managing this amount of information falls behind the data revolution. Therefore, as the medical field enters the era of big data, medical education must address data processing and application.

## Footnotes

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## References

1. Sengupta PP. Intelligent platforms for disease assessment: novel approaches in functional echocardiography. *JACC Cardiovasc Imaging*. 2013;**6**(11):1206–11. [PubMed ID: 24229773]. https://doi.org/10.1016/j.jcmg.2013.09.003.
2. Moskowitz A, McSparron J, Stone DJ, Celi LA. Preparing a New Generation of Clinicians for the Era of Big Data. *Harv Med Stud Rev*. 2015;**2**(1):24–7. [PubMed ID: 25688383]. [PubMed Central ID: PMC4327872].
3. Feinleib D. The Big Data Landscape. In: Feinleib D, editor. *Big Data Bootcamp*. New York, USA: Apress; 2014. p. 15–34. https://doi.org/10.1007/978-1-4842-0040-7_2.

4. Muni Kumar N, Manjula R. Role of Big data analytics in rural health care-A step towards svasth bharath. *Int J Comput Sci Inf Technol*. 2014;**5**(6):7172–8.
5. Subrahmanya SVG, Shetty DK, Patil V, Hameed BMZ, Paul R, Smriti K, et al. The role of data science in healthcare advancements: applications, benefits, and future prospects. *Ir J Med Sci*. 2022;**191**(4):1473–83. [PubMed ID: 34398394]. [PubMed Central ID: PMC9308575]. https://doi.org/10.1007/s11845-021-02730-z.
6. Ventola CL. Big Data and Pharmacovigilance: Data Mining for Adverse Drug Events and Interactions. *P T*. 2018;**43**(6):340–51. [PubMed ID: 29896033]. [PubMed Central ID: PMC5969211].
7. Bibault JE, Giraud P, Burgun A. Big Data and machine learning in radiation oncology: State of the art and future prospects. *Cancer Lett*. 2016;**382**(1):110–7. [PubMed ID: 27241666]. https://doi.org/10.1016/j.canlet.2016.05.033.
8. Hsu KC, Wang FS. Model-based optimization approaches for precision medicine: A case study in presynaptic dopamine overactivity. *PLoS One*. 2017;**12**(6). e0179575. [PubMed ID: 28614410]. [PubMed Central ID: PMC5470743]. https://doi.org/10.1371/journal.pone.0179575.
9. Dente CJ, Bradley M, Schobel S, Gaucher B, Buchman T, Kirk AD, et al. Towards precision medicine: Accurate predictive modeling of infectious complications in combat casualties. *J Trauma Acute Care Surg*. 2017;**83**(4):609–16. [PubMed ID: 28538622]. https://doi.org/10.1097/TA.0000000000001596.
10. Caleb K. The Internet of Things: Impact and Implications for Health Care Delivery Background of Digital Devices and the Internet of Things. *Reaserchgate*. 2022.
11. Bates DW, Saria S, Ohno-Machado L, Shah A, Escobar G. Big data in health care: using analytics to identify and manage high-risk and high-cost patients. *Health Aff (Millwood)*. 2014;**33**(7):1123–31. [PubMed ID: 25006137]. https://doi.org/10.1377/hlthaff.2014.0041.
12. Badawi O, Brennan T, Celi LA, Feng M, Ghassemi M, Ippolito A, et al. Making big data useful for health care: a summary of the inaugural mit critical data conference. *JMIR Med Inform*. 2014;**2**(2). e22. [PubMed ID: 25600172]. [PubMed Central ID: PMC4288071]. https://doi.org/10.2196/medinform.3447.
13. Celi LA, Mark RG, Stone DJ, Montgomery RA. "Big data" in the intensive care unit. Closing the data loop. *Am J Respir Crit Care Med*. 2013;**187**(11):1157–60. [PubMed ID: 23725609]. [PubMed Central ID: PMC3734609]. https://doi.org/10.1164/rccm.201212-2311ED.
14. Sanchez-Pinto LN, Luo Y, Churpek MM. Big Data and Data Science in Critical Care. *Chest*. 2018;**154**(5):1239–48. [PubMed ID: 29752973]. [PubMed Central ID: PMC6224705]. https://doi.org/10.1016/j.chest.2018.04.037.
15. Thomas R, McSharry P. *Big Data Revolution: What farmers, doctors and insurance agents teach us about discovering big data patterns*. Hoboken, USA: John Wiley & Sons; 2015.
16. Dash S, Shakyawar SK, Sharma M, Kaushik S. Big data in healthcare: management, analysis and future prospects. *J Big Data*. 2019;**6**(1). https://doi.org/10.1186/s40537-019-0217-0.