Profitability and effects of artificial intelligence and automation on the future of Physicians

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Abstract

   The complexity of determining full automation for a Physician is a daunting task. The occupation of a Physician is a multi-faceted machine which includes but not limited to the breakdown of tasks and their likelihood of automation, feasibility, and infrastructure. Global factors such as Globalization, Intersectionality, and Political Economy. These factors play an important role in determining the susceptibility of automation and where artificial intelligence fits. A Physician provides treatment from disease, injury, and illness along with administrative tasks. While all Physicians share early education and responsibilities, there are many different specialties which complicates the subject. Each specialty of a Physician should be treated as an individual occupation with its own risks. Yet it is important to capture the tasks that all Physicians perform to get the best model for the occupation as a whole. How artificial intelligence plays a role in the automation of a Physician is a matter of determining the reality of what part of a Physicians day to day job can be replaced by an artificial intelligence, whether the artificial intelligence supports a Physicians current role, and if financial decisions support or impede its advancement. Determining where the line is between artificial intelligence and its co-existence with Physicians is important to distinguish whether automation is a risk. This report attempts to analyse the expectations that artificial intelligence plays in the future of Physicians motivated by profitability. How the advancement of technology pertaining to artificial intelligence may affect Physicians and their role in the future.

Keywords: future of work, automation, artificial intelligence, physicians, medicine, profitability, business

1. Methods

1.1 Initial Analysis

   The McKinsey Global Institute released a report which analysed the future of automation for a variety of occupations [1]. An initial model was created that followed the McKinsey reports methodology to determine the break down of Activities performed by a Physician. These Activities are mapped to a set of capabilities. In an attempt to show the type of skills needed for each of these tasks to be performed. Which breaks down the complexity of the overall occupation. The mapping of activities onto capabilities gives an analysis of the likelihood of their automation. The overall findings of this report was that automation for a Physician is incredibly unlikely. Most Activities mapped to cognitive or physical capabilities that have a low susceptibility.

1.2 Revised Analysis

   A revised analysis was conducted with the inclusion of primary source interviews to improve the reality of the day to day tasks that Physicians perform. A new model was which included the dimension of time to capture as many tasks as possible was created in an effort to analyse how much of each day in a physician's work is susceptible to automation. With the inclusion of time and data; a more realistic representation of what a Physician does is captured. The previous model erroneously suggested Activities that were actually performed by ancillary staff. It keeps the notion of mapping Activities to capabilities as it was seen by the interviewees as an appropriate method to assess the day to day skills of a Physician.

1.3 Expanded Conceptual Model

The expanded analysis introduced the concepts of Globalization, Intersectionality, and Political Economy and the role that they play in determining the incentive for automation. Globalization was narrowed down to the migration of Medical Students, Physicians across borders, and Medical Tourism. Intersectionality discussed the discrimination of Physicians based on ethnicity/race and how that played a role in Physician job turnover. Political economy expanded on imbalance of primary and specialty care and the historical relevance.

1.4 Interviews

Interviews with two Physicians were conducted. A General Practitioner and a Radiologist. The interviews were open discussion to determine the reality of tasks performed, likelihood of automation of those tasks, and the role artificial intelligence could potentially play in their occupation.

2. Artificial Intelligence vs. Automation

It is important to note the difference between Artificial Intelligence and Automation in this context. Complete automation is the elimination of the occupation of a Physician. While in this scenario there could be a new occupation that oversees the maintenance in this hypothetical automation. Artificial Intelligence has an important role in changing certain aspects of the job. The use of artificial intelligence and automation interchangeably or as synonyms is incorrect. Artificial Intelligence has the potential to completely automate certain aspects of a Physicians job. Documentation and administrative tasks are found to be the highest types that could be completely automated [1]. Radiology has a high risk of automation yet according to the literature there will be a long period of co-existence and support with Physicians [2]. Other aspects of a Physician's day to day tasks such as Physical tests have a very low risk for automation [1]. These types of tests require a marriage between robotics, artificial intelligence, and the Physicians involvement. To be clear artificial intelligence does not mean pure automation. It could help automate, improve or co-exist, and interfere with a Physician's occupation.

3. Business Perspective

Healthcare, Pharmecy, Health Insurance, eduation and all other industries that are tangentally related to the occupation of a Physician are related to business. The motivation behind the evolution of artificial intelligence and automation largely seen as providing care to patients but also financially for these industries.

3.1 Profit and Bottom Line

The motivation for artificial intelligence from most news outlets appears to be the benefit of the patient and the work of a Physician. The profit from these artificial intelligence systems could be vast if their error rate is reduced to below the threshold of a human Physician. High premiums could be placed upon the payment structure similar to how historically specialty care lead to inflated costs [3]. While the co-existence of Physicians and artificial intelligence could also lead to higher cost. Patients who are willing to pay for top of the line treatment could seek out these new advancements for better care. As for complete automation of the Physician is unrealistic in a purely profitable sense unless the business of educating a Physician is outweighed. Educating medical students and the use of specialty hospitals and surgeons is a business in and of itself [3]. If Physicians were completely automated then this hospital structure would become obsolete. The arguments against this are the current savings in cost that artificial intelligence is predicted to make. Physicians are one of the most highly respected and skilled occupations. Their wages and salaries are among the highest. If certain specialties can be fully automated then the hospital investment for certain procedures could be saved. Human's also make mistakes which can have insurance and malpractice costs. Artificial intelligence could lead to savings once the technology limits these errors. The bottom line appears to be the co-existence of artificial intelligence and Physicians working together. Some specialties or sections of a Physician's day to day work will be automated, however, for the forseeable future the susceptibility for full automation of the occupation is low from a business perspective.

3.2 Disruption

The innovation behind what drives the advancement seems like a unstoppable force. This would be a technological determinism point of view. Technology seems as though it will take over but that is largely not the case and this report would like to avoid that type of speak. Business pushes technology forward along the edge of policy and laws but these are limitations that it will face. People also want to push the technology forward to see advancements. Such as improvements in surgery, pharmecuticals, and the diagnostic process and some also may want to hinder the technological process such as with genetic augmentation. This side of the argument leans more toward a social construction of technology argument where technology is shaped by people. The view between these two arguments is Mutual Shaping which is where this report lies. The profit of artificial intelligence will be pushed forth by technological advancement and laws will be shaped around them.

The inclusion of artificial intelligence will be a disruption in different aspects of a Physicians occupation. The education of a Physician is already a long process and the more technology that is released, the more it complicates the learning process [2][3]. Surgeons for example have years of training after medical school and many of their tasks are enhanced by the use of technology. The more technology that is weaved into their occupation means more training and more

retraining when these systems are updated. This increases the importance of highly trained surgeons because of the number of technologies that they are familiar with and their ability to be retrained.

Hospitals and Urgent Cares also have complex work environments. Ancillary staff iteract with Physicians and technology can impede productivity [2]. Introducing these systems could cost a lot and interfere with the work flow. Implementation and creation of these systems also costs a significant amount. There needs to be a long term financial gains if these systems are to be warranted.

3.3 Efficiency and productivity

The efficiency of artificial intelligence systems hinge on how well they are implemented into the complex system and if the training of their systems lead to savings in time with their use. If these systems remove large portions of the Physician's daily tasks then an improvement in efficiency can be noticed. Using the Workday-Task model from the revised analysis and interviews from the Physicans, the diagnostic process is at risk for being automated [2]. The diagnostic process includes recording patient history and then finding patterns in that history so it can be categorized into a disease or illness for diagnosis. It is a large section of patient interaction which is repeated in the day of work of a Physician. If this can be automated with a low margin of error then more patients can be seen in a day improving productivity. It's important that the error be as close to the average of Physician's error rate for these systems to be trusted.

During the interviews for the revised analysis it was determined that a lot of administrative tasks are performed by ancillary staff such as Nurses and Receptionists [2]. Tasks such as recording patient insurance and general information or taking patients preliminary tests like vitals. This can also be included in what was said before such as patient history from the diagnostic process. Smaller practices which have less staff have the Physicians do a larger portion of these tasks. With automation of these tasks it can free up time for the Physician to focus on the tasks that only they are qualified to perform.

Robotics also has some uses for efficiency and productivity. Surgery is a very slow and meticulous process. If robotics are improved to help or replace surgeons then more surgeries can be performed in a given time. This can also help reduce strain on the remaining surgeons, potentially lowering the mistakes and error rate.

3.4 Initial Capital

Initial capital for artificial intelligence and automation options for hospitals and urgent cares is very expensive. Historically health care technology costs a lot to research, develop, and implement. Convincing hospitals to use these systems requires time and money from representatives. Yet the cost is small considering the potential that automation has on the industry from the bottom line.

For a lot of machine learning models, large amounts of data is needed for the model to perform well. Data collection systems would need to be payed for or outsourced. Then research and development for the types of artificial intelligence and automation. Models would also need to be created to make projections of the viability of the effectiveness of these models so initial capital is not wasted.

Other areas of interest include intersection of artificial intelligence and robotics. These types of systems are incredibly expensive because of long term investments after the initial capital.

Technology also is created on the border of laws and regulation. It's important to place initial capital in places where the law is potentially able to evolve for the use of these technologies. If capital is placed in a technology that is highly regulated then a return on investment might not be possible. This could also motivate the use of lobbyists to push the boundries of policy for the purpose of profit.

Acquisitions of artificial intelligence startups are currently ongoing [4]. Current firms already see a large promise in these technologies. The momentum of this is evidence of the potential for these systems.

3.5 Long Term Investment

After initial capital is placed there could be very long periods of investment due to the nature of research, development, and cost of startups. It could also take a very long time for policy to be pushed on decided at the rate of technology. This is why the intial captial has to be placed in promising areas. The effectiveness of these models also need a lot of testing. The mistakes of bad data or incorrectly implemented systems could cause large financial losses.

4. Profitability

4.1 Savings

Profitability can also be gauged in the amount of money saved. According to a report by Accenture, *Artifical Intelligence: Healthcare's New Nervous System,* the savings that artificial intelligence has projected is roughly 150 billion [4]. A lot of the report reiterates and reinforces what this research has discussed. The artificial intelligence models can automate a lot of the administrative tasks from Physicans and Ancillary staff which can allow for more patients and better results. With better results facilities and Physicians have better satisfaction and new patients seek this out.

The key areas where saving will be are robotic surgery, virtual nursing, administrative workflow, fraud detection, Dosage Error Reduction [4]. While this research questions the full automation of Physicians the potential savings that artificial intelligence is undeniable.

4.2 Infrastructure

Hospitals and urgent cares run on a lot of reduncy to maintain the credibility of results and to reduce error [2]. Miscommunication and mistakes in documentation can also lead to Physicians, Nurses, and Technicians repeating and performing the same procedures. For example, when reading an X-ray an X-ray technician, Nurse, Physician, and maybe a Radiologist all have to be involved with the reading [2]. These all have to be scheduled. Time conflicts may make the process very inefficient which lead to reduction in patients seen. If these systems can be implemented to reduce redundancy within the workplace then more patients can be seen increasing output.

Specific leverage points can also be examined to potentially improve profitability. An emergency room is a chaotic and complex environment. The process of bringing in patients is already an efficient process, but if certain aspects can be automated to not require a Physician then they can focus their efforts on other patients.

The same can be said about surgery. Robots that could be included in the surgeons room are expensive products to build and train people on, but if more patients can be seen then more operations lead to more profit.

The implementation of these systems into the hospitals will also be a profitable endeavor. Hospitals and other companies might be willing to put investment into these for improved care and patient satisfaction which would be a corrollary of these systems. This results in more work or new jobs that work with the hospital to help implement them.

As for the automation or replacement of Physician tasks, ancillary staff can be trained to perform some of the work a Physician does: Physician Assistants and Nurse Practicioners [2].

4.3 Security

Hospital and Physicians work with a lot of sensitive data and fraud. Artificial intelligence models also work with the protection of this data and determining if someone commits fraud [4]. This might not be completely related to the occupation of a Physician but to the insurance and patient rights which affect malpractice and Physician legitimacy. This could help save money and time for Physician employers.

4.4 Salaries

Physicians have a wide range of salaries. Radiologists for example are paid on average 400,000 a year [1][2]. Across all hospitals that is a large amount paid in salaries. Incentive for automation for these highly paid specialties that are more at risk for automation could be savings as well. This money could be then used to pay for artificial intelligence systems for imaging. These systems would then pay for themselves and not need a salary of their own to continue working. Other specialites such as a General Practicioner are paid on average 170,000 a year [1][2] . This is much lower and a more difficult

type of Physician to automate. If more specialty care is automated then more primary care Physicians could be hired improving care [3]. This then lessens the risk for automation for Primary Care Physicians. It also still holds the business of education.

Physicians Assistants and Nurse Practioners are moderately paid ancillary staff that perform a lot of the tasks that a Physician performs. Less than Physicians though. Future education schemes for these careers could possibly take on more of the responsibilites of a Physician in the event that the Physicians tasks are automated; more with time.

5. Conclusion

The overall landscape has mixed results on the future of a Physician being automated. Artificial intelligence has many ways to disrupt the occupation of a Physician but also improve the workflow depending on how well these systems are created and implemented. Certain specialties have a higher risk of being automated.

The education system for Physicians is a business in its own right which lessens the likelihood of full automation for the forseeable future. Unless the automation of Physicans saves more money and is more profitable than what they currently support.

Artificial Intelligence models and startups still hold a lot of promise supporting the argument that there is viability in their results. There are massive financial savings in saving time for Physicians and ancillary staff to see more patients.

The higher salaried specialties that are at risk to be automated could help cut costs and that money could then be used to pay for these artificial intelligence systems and more Primary Care Physicians. This supports the idea that the general practicioner is less likely to be automated. The education of Physicians will still be financially stable.

Although this research sides with a low susceptiblity of automation for Primary Care Physicans, ancillary staff in the future could possibly take on more tasks associated with Physicans. There could be a new occupation which also oversees the automation that Physician would currently perform. Yet this would be far in the future.

The more likely scenario is Physicians and artificial intelligence systems co-existing. Automation will be in the form of efficiently pushing more patients through the system and less error rates or mistakes.

References

[1] Initial Analysis, O'Brien
[2] Revised Analysis, O'Brien
[3] Expanded Model, O'Brien
[4] Accenture (2017) *Artificial Intelligence: Healthcare's New Nervous System.*