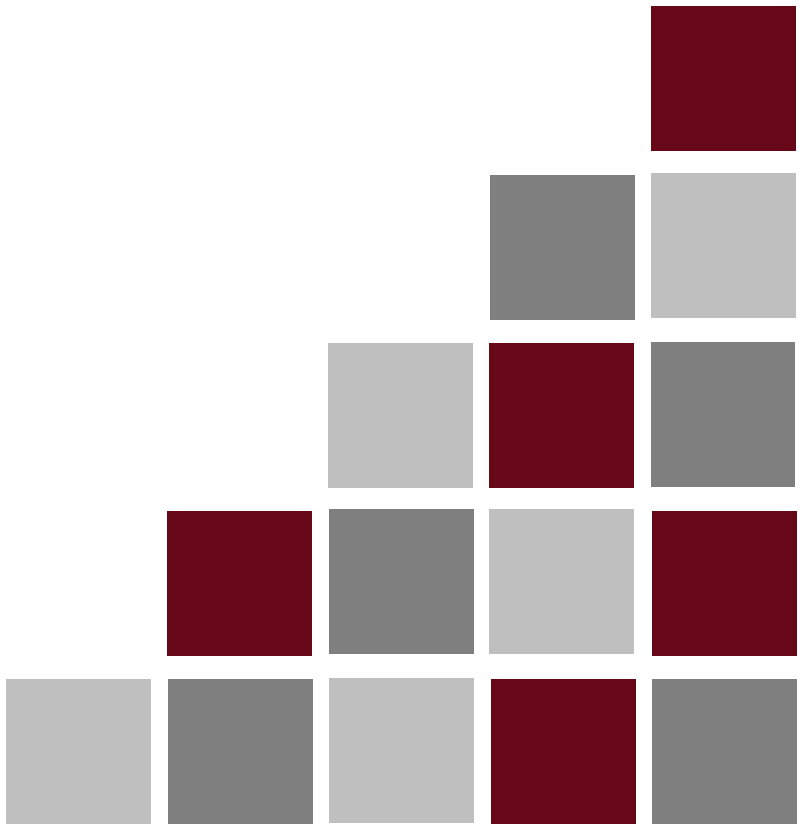
Principles by IUCG:

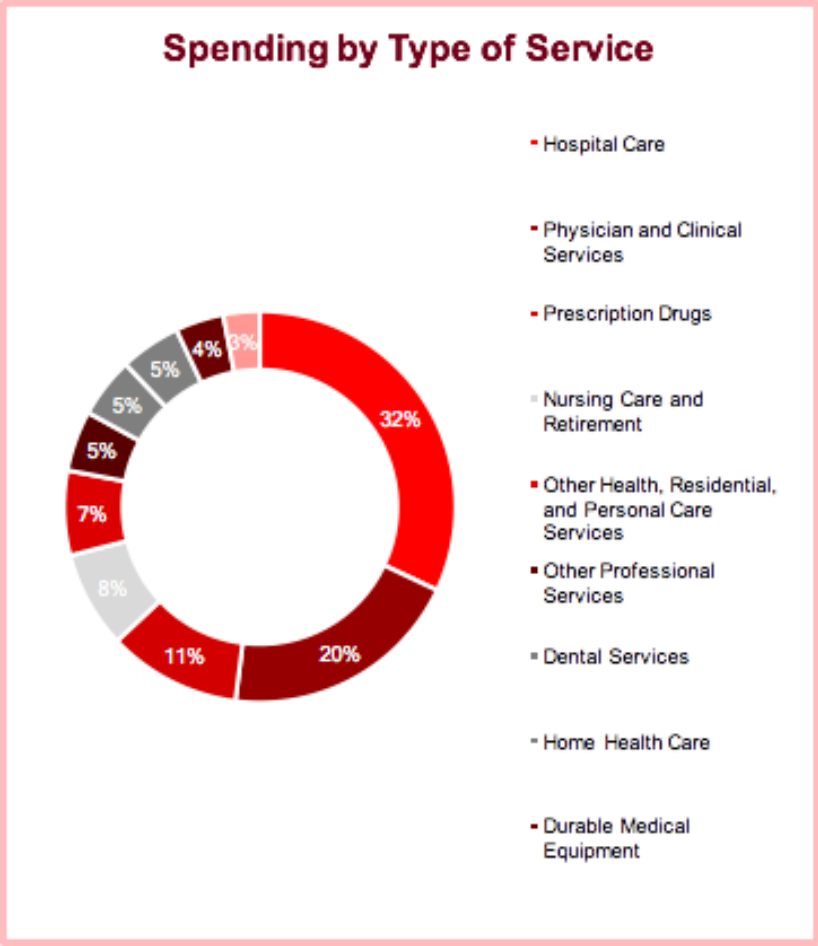
Emerging Technologies in the Healthcare Industry



INDUSTRY OVERVIEW

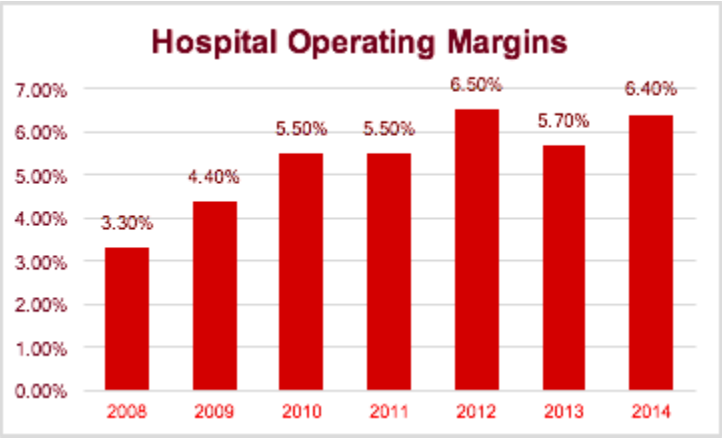
Introduction

Healthcare is defined by experts as the maintenance and improvement of physical and mental health, especially through the provision of medical services.[1] We see this reflected in the breakdown of the industry as the top-spending sub-industries are hospital care and physician and clinical services, which together make up more than half of the industry spending.[2] Artificial intelligence directly impacts the hospital industry through doctor-patient interactions and data collection methods. This report serves to analyze and discuss the growing presence and impact of artificial intelligence in the hospital industry.



CURRENT ISSUES

Operating Margins



Historically, hospitals have operated on thin margins. Since 2012, operating margins have remained consistent. Thin margins are caused by expenses growing at a faster rate than revenues. From 2015 to 2016, expenses grew 7.5%, while revenue only grew 6.6%.[3] The growth in expenses can be attributed to increased labor costs due to the aging population as well as a shortage of nurses.

This is a critical fact because shrinking margins are pushing hospitals to look for new streams of revenue. For example, increased system efficiencies, increased integration, and improved revenue cycle systems are all potential changes that CEOs are looking to make.[3] Hospitals, as well as other healthcare service facilities, are willing to make changes to increase their margins. This is a big opportunity for hospitals to leverage and implement new technologies.

Volume to Value Shift

Volume based payment systems, also known as fee-for-service, are costly and provide low levels of quality. Using this payment structure, the provider charges a set fee for a certain service. This has led to excess uncompensated care costs, which reached a high of $46 billion in 2012.[4]

The shift to value-based payment systems would change the payment plans to fee-for value. In theory, this type of payment plan is beneficial to hospitals, patients, and insurers. The goal is that healthcare providers deliver the best quality care possible at the lowest cost. This way, patients get the best possible care and insurers get a good

value. This is beneficial for hospitals as it reduces uncompensated costs. Just last year, nationally, hospitals reported that 50% of the reimbursement they received was related to value measurement. In 2015, uncompensated costs hit a 26-year low at $35.7 billion and the number of accountable care organizations rose dramatically from 660 to 838. [4]

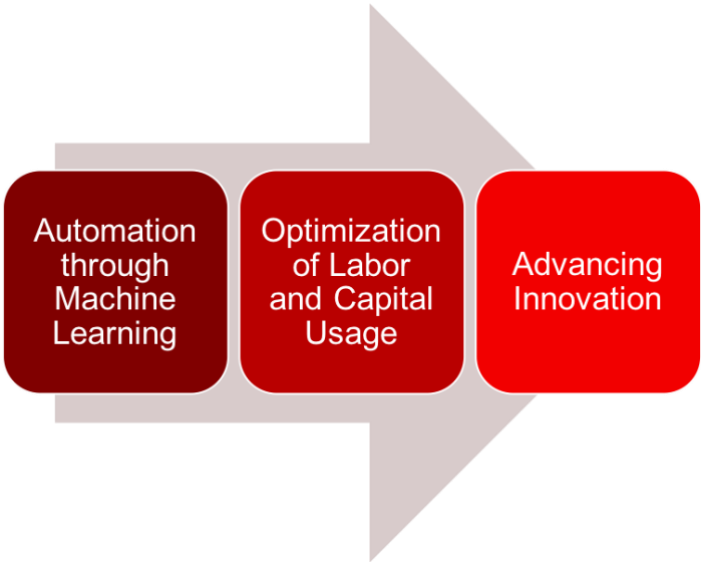
Based on the positive results that have come from this implementation, we believe that the shift from volume to value will continue across the healthcare industry. However, it still remains difficult for hospitals to increase quality and lower prices simultaneously. One of the necessary factors for value-based care to be successful is the need for more data and integration across companies in order to increase efficiency and accuracy.

NEW TECHNOLOGIES

Artificial Intelligence in Healthcare and its Projections

As of 2018, over 600 million dollars have been invested in acquiring AI infrastructure and startups. Experts in the industry expect a compounded annual growth rate (CAGR) of 40% to over 6.6 billion dollars in spending by the year 2021.[5] The primary reason for this is that there is already an established proof of concept. For example, El Camino Hospital in Silicon Valley implemented an artificial intelligence program that reduced the fall rate of patients by over 39%.[6] This software utilized machine learning to comb over electronic health records to predict which individuals are most likely to fall using real-time tracking of patients. Other preliminary trials of AI have also been successful at enhancing patient care. Overall, this $6.6 billion investment will result in over $150 billion dollars in savings by the year 2026.[5]

Why Artificial Intelligence?



Automation through Machine Learning

Through automating health record analysis using machine learning software, hospitals can rapidly analyze millions of health records to forecast health risks and tailor individual treatments for patients. *Enlitic*, a healthcare intelligence company, focuses on delivering individual solutions using deep learning mechanisms by combing through billions of clinical cases to improve diagnostics and patient outcomes.[7]

Another breakthrough in automation is the instruction of virtual nursing assistants (VNA). This utilization of AI to remotely assess a patient's symptoms and deliver alerts to clinicians only when patient care is needed is significant and reduces unnecessary hospital visits. Artificial Intelligence helps registered nurses (RNs) save 20% of their workday by avoiding these unnecessary visits; this number will continue to increase as VNAs become more popular. Both of these software applications are projected to increase profit margins by 5% in three years.[5]

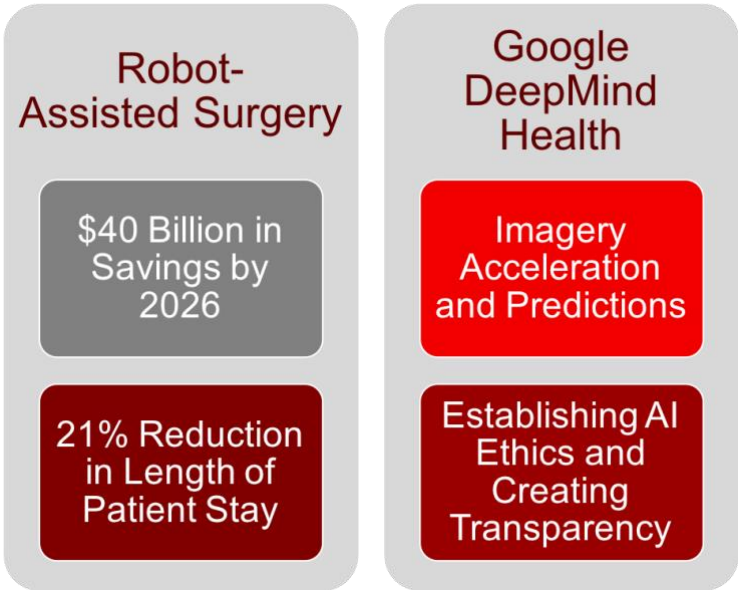
Optimization of Labor and Capital Usage

A lingering problem facing physicians today is worker burnout. Burnout, defined as physical and emotional exhaustion due to prolonged stress, has become increasingly prevalent among U.S. physicians. Nearly 50 percent of physicians reported frequent or constant feelings of professional burnout in the past year and they attributed this to two factors: electronic health record data entry and increased clerical requirements.[4]

This is a problem that we believe can be solved with the introduction of voice-to-text transcription software and voice-enabled symptom checkers. Doctors can now spend more time with their patients, which is a benefit for both parties.

Advancing Innovation

Currently, we believe there are two projects that are going to surge the popularity and effectiveness of artificial intelligence solutions in the public scope.



Companies such as Mazor Robotics have pioneered robot-assisted surgery as a precision tool using a 3-D CAT scan and pinpoint the exact areas of surgical implantation. This new tool can integrate information from pre-operation records and use real-time surgical experiences to continuously improve overall outcomes of patients.[5]

Another project headed by Google DeepMind Health is currently working on reducing the stigma around artificial intelligence and creating more transparent communication between the public and the companies dealing with highly private patient data. They have established an ethics board with other AI giants such as Microsoft, IBM, Amazon and Apple to assure that data security is upheld to the highest standard. Google DeepMind Health focuses on applications that assist doctors and nurses to diagnose health problems quicker and more accurate than before. The company's long-term vision lies in the implementation of user-friendly AI in healthcare worldwide.[8]

LONG-TERM EFFECTS

Positive Effects

There are numerous positive effects that have already appeared or are expected to appear in all aspects of the healthcare sector. We are already seeing improved imaging diagnoses and that area will continue to grow. Outcomes are expected to improve by 30-40%, in part due to the mitigation of errors or oversights in all aspects from diagnoses to paperwork.[4] AI also has the potential to reduce treatment costs up to 50% as well as translate unstructured data much faster and with more accuracy than humans, saving time and money.[9] Finally, looking on a more global scale, eventually AI can increase healthcare availability in underserved populations. A lot of these effects will help the healthcare industry meet industry goals such as reducing administrative costs, improving patient outcomes, and coordinating care, which is why we think that AI will be so important to the healthcare industry moving forward.

Winners and Losers

Product of AI	Who Benefits?	Who Loses?
Fewer Admissions	Insurers, Patients	Hospitals
Scheduling & Billing Efficiency	Hospitals	Insurers
Supplies Management	Hospitals, Patients	
Clinical Trial Enrollment	Patients, Pharmaceuticals	

There are a lot of effects that either have occurred or could occur with the implementation of AI. This table shows how different outcomes affect different stakeholders in the healthcare industry. Here, we focus on hospitals, patients, and insurers since these are the biggest players.

1. **Fewer Admissions:** Insurers and patients both benefit from this outcome because they do not have to pay for as many visits, especially since each visit is an added cost. However, in this situation, hospitals lose because fewer admissions means lowered revenue.
2. **Increased Efficiency:** This case benefits hospitals because they save money if they can run more efficiently. However, Insurers lose because there are fewer billing mistakes, ensuring that they pay the full amount that is owed to the hospital and therefore reducing uncompensated costs.
3. **Supplies Management:** An increase in efficiency in this are benefits both hospitals and patients because hospitals see lower costs in terms of shipping and inventory and they can pass those lower costs along to their patients.
4. **Clinical Trial Enrollment:** Finally, clinical trial enrollment done by Artificial Intelligence benefits patients because they save money on drugs that move to the market more quickly. Pharmaceutical companies are also benefitted because they save money on data collection, while hospitals are not affected.[10]

Although we see hospitals and the healthcare industry losing money in some areas, we also see the diminishing of uncompensated care while seeing the satisfaction of patients rising.

MOVING FORWARD

In the midst of this growth that we see happening, it is important to keep some things in mind in order to keep AI on the successful path that it is currently on. The biggest thing to remember is that artificial intelligence is not a replacement. Rather, it is a supplemental technology that has the capability to increase the efficiency and effectiveness of solutions. Moving forward, we believe that the following actions will help AI continue to grow successfully.

- Implementation should start small in back-office areas such as supply change and administration.
- Encouraging learning with AI to reinforce doctor responsibility of patient care is another key focus in order to keep patients both safe and at ease. This also keeps doctors accountable and prevents worries over job loss.
- Creating a standard of ethics will help patients feel comfortable because they will understand the limitations of AI. It also makes sure that everyone involved is on the same page.
- Establishing more transparency in hospitals and other institutions will allow all stakeholders to clearly see, understand, and trust the process. Allowing patients to see the benefits of AI will encourage participation.

We believe that these strategies will help keep patients happy, while allowing doctors to do more accurate work, in turn raising profits for the healthcare industry.

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