Using AI to meet operational, clinical goals

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For healthcare IT leaders there is an opportunity to use AI to address operational efficiencies and support clinical decision making.

Healthcare is more complex today, and there is more of it to provide. Stretched by increasing costs[1], a global deficit of health workers and operational inefficiencies, the need to address demand for high-quality and efficient care is urgent. With growing aging our healthcare systems are having to find new ways to care for an increasing number of older people with more complex health conditions.

For health IT leaders, the goal of operational efficiency looms large alongside the pressure to do more with the huge volumes of data they collect enterprise wide. The rise of connected health devices, hidden pockets of unstructured data and a lack of interoperability between IT systems inhibit their ability to do more with the data they have.

In this paper we will explore how artificial intelligence (AI) can help health IT leaders drive operational efficiency and support clinical decision making.

The need for AI in healthcare

- **Growing and aging populations,** alongside an increasing number of people suffering from chronic conditions. The World Health Organization (WHO) projects that by 2020 chronic diseases will account for almost three-quarters of all deaths worldwide[1].

- **Escalating healthcare costs.** In 2015, US healthcare spending increased 5.8 percent to $3.2 trillion[2]. The EU spends around 10% of its GDP on healthcare. Between 70% and 80% of EU healthcare costs are spent on chronic care, amounting to $700 billion[3].

- **Operational inefficiencies.** In 2012, the Institute of Medicine estimated that the US healthcare system wastes $750 billion annually. Two of the main sources of waste are unnecessary services and inefficient care delivery[4].

- **Staff shortage.** The WHO estimates that by 2035 there will be a global deficit of about 12.9 million skilled health professionals (midwives, nurses and physicians).

- **Value-based reimbursement** will increasingly demand evidence of better patient outcomes at lower cost.

[1]World Health Organization (WHO)
[2]WHO, 'Global health workforce shortage to reach 12.9 million in coming decades'
[3]European Commission
[4]The Atlantic

Great data, few insights

"What healthcare providers have is incredible data, but very few insights. And what clinicians really want is insights — to tell them what they need to know."

Roy Smythe,
Chief Medical Officer for Health Informatics, Philips

AI is now gaining traction in healthcare because of its ability to help generate insights from large amounts of data — offering a much-needed helping hand to overburdened staff.

Over the past decade, there has been an exponential growth of computational power, while the cost of data storage has dropped dramatically. Today, all medical images are digital, with some of Philips' customers generating more than 2 million images a week. The amount and granularity of the stored digital medical and healthcare data a CIO oversees has increased exponentially, but just a fraction of it is being used to improve the quality and efficiency of care.

"What healthcare providers have is incredible data, but very few insights," says Roy Smythe MD, Chief Medical Officer for Health Informatics, Philips. "And what clinicians really want is insights — to tell them what they really need to know. For example, among the 2000 diabetics in their patient population, who are the 10 that they need to bring in for a different intervention? Those are insights that they need."

This huge growth in volume and diversity is a concern for health IT leaders because the speed of data accumulation is far outpacing the ability to analyze it. Compounding the problem is the fact a lot of healthcare data is unstructured — as much as 80%[5] is not contained in a database or some other type of data structure. Unlike many other industries where the data is relatively "clean" and normalized, a lot of clinical information is currently captured in medical notes of various kinds and sits idle in a department system. This makes it even more challenging to quickly extract insights from multiple data sources.

[5]PWC, 'Trends in AI'

The data explosion

- Philips customers generate more than **2 million medical images** a week.

- **7 million seniors** have been supported with Philips wearable Lifeline monitoring service.

- Our patient monitoring solutions monitor around **275 million people** every year in ICUs (intensive care units), general wards, and people's homes, generating huge amounts of data.

- Sleep & Respiratory care business has collected **2.5 billion nights** of cloud-based sleep therapy data over 10 years from more than 5 million connected sleep therapy and ventilation devices.

AI opportunities in healthcare

There are four key ways in which AI can support the goals of health IT leaders as they continue to manage their digital transformation:

1. Improve operational performance and efficiency

By extracting insights from data, AI-enabled solutions can support clinicians to optimize their workflows. In many ways, it is redefining the way they work. They can pull up images in the order that they prefer, find the images of interest to them from large numbers of potential images and measure lesions and quantify changes in size and shape.

"We are mainly using AI now to make clinicians more efficient," says Dr.Smythe. "Today an AI platform can learn how the physician works, and eliminate the non-value added tasks in their workflows. We are actively applying machine learning to improve the workflow for clinicians, especially in diagnostic imaging."

On a departmental and enterprise level, the ability of AI to sift through large amounts of data can help hospital administrators to optimize performance, drive productivity, and improve the use of existing resources, generating time and cost savings. For example, in radiology, areas where AI could make a difference include the management of referrals, patient scheduling, and exam preparations. Improvements here can help to enhance patient experience and will allow a more effective and efficient use of the facilities at examination sites. This could be accomplished by using specialized AI engines and algorithms for:

- **Scheduling:** for example predicting no-show patients to optimize schedules.
- **To determine (and, if necessary, adjust) a certain imaging protocol:** to best answer the patient's individual clinical question.
- **Scanner utilization:** to best match a daily patient schedule to the existing imaging facilities in a department.
- **Information extraction from reports:** for example, identify the relevant prior exams or implement a consistency check.
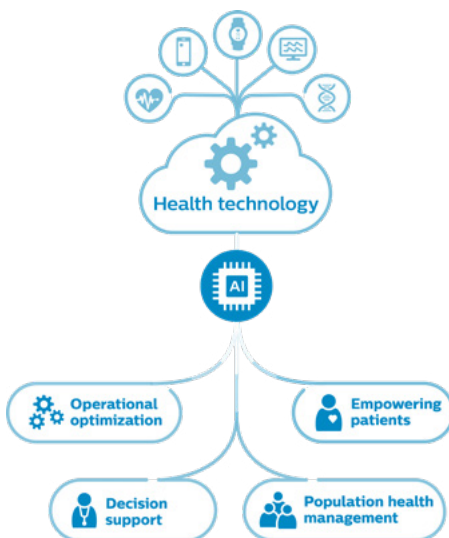
> "An AI platform that has been trained by enough data over time won't just tell you which 10 patients you need to attend to, but it will suggest what you should do."

Roy Smythe,
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2. Supporting high-quality and integrated clinical decision-making

AI-enabled solutions can help to combine large amounts of medical data to generate a more holistic view of patients. This supports healthcare providers in their decision making, leading to better patient care and improved population health.

"The need for insights and for those insights to lead to clinical operations support is tremendous," says Dr. Smythe. "Whether that is the accuracy of interventions or the effective use of manpower – these are things that physicians struggle with. That is the imperative."

The impact of AI-enabled solutions to strengthen medical imaging diagnosis processes and hospital workflows could improve patient care and significantly reduce treatment costs[6]. By analyzing large amounts of medical data AI can help to quickly identify patterns and give clinicians a fuller profile of each patient and patient population. "An AI platform that has been trained by enough data over time won't just tell you which 10 patients you need to attend to, but it will suggest what you should do," Dr. Smythe says.

Relevant information can be extracted and used to automatically highlight any issues that would be relevant to the clinician, analyzing subtle differences between images to allow a clinician to determine whether treatment regimens have been effective. Through digital pathology, we can use AI to identify the right tissue, then process the tissue and identify specific biomarkers within that tissue.

[6]Frost & Sullivan

As the population ages, so does a desire to age in place when possible, and to maximize not only disease management, but quality of life as we do so.

3. Enabling population health management

Combining clinical decision-making support with patient self-management, population health management can also benefit from AI. Based on predictive insights in patient populations, healthcare providers will be able to take preventative action, reduce health risk, and save unnecessary costs.

"In the case of major disease conditions—such as cardiac, pulmonary, and oncology—we will be able to combine images, clinical data, demographics, and genomics to make predictions about prognosis, best treatment, and any potential complications," says Dr. Smythe. "In the future, this will involve looking not only at the patterns and outcomes from individual users, but from millions of them[7]."

As the population ages, so does a desire to age in place when possible, and to maximize not only disease management, but quality of life as we do so. The possibility of aggregating, analyzing and activating health data from millions of consumers will enable hospitals to see how socio-economic, behavioral, genetic and clinical factors correlate and can offer more targeted, preventative healthcare outside the four walls of the hospital.

One example is the eIAC ambulatory telehealth program for elderly people living with multiple chronic conditions, which is built upon a population management software platform designed for monitoring and delivering care to the most complex patients at home. Thousands of patient years of data enables an intelligent technology that can identify when a patient needs assistance or is at risk for emergency transport to the hospital in the upcoming 30 days.

[7]AI Business, 'Medicine Needs A Paradigm Shift – And AI Could Be The Answer'

Beyond the hospital, AI offers tremendous opportunities as it gets embedded into solutions for home care and healthy living.

4. Empowering patients and consumers

As recently as 2015 patients reported physically carrying x-rays, test results, and other critical health data from one healthcare provider's office to another[8]. The burden of multiple referrals, explaining symptoms to new physicians and finding out that their medical history has gaps in it were all too real. Patients now are demanding more personalized, sophisticated and convenient healthcare services[9].

The great motivation behind AI-enabled healthcare is that increasingly, as patients become more engaged with their own healthcare and better understand their own needs, healthcare will have to take steps towards them and meet them where they are, providing them with health services when they need them, not just when they are ill.

With healthcare moving to lower-cost care settings, the rise of retail clinics and a growing perception that non-traditional health delivery models improve access to care, the future of healthcare is increasingly moving outside of the hospital walls. Beyond the hospital, AI offers tremendous opportunity as it gets embedded into solutions for home care and healthy living, enabling people to take control over their own health, supported by intelligent advice as they need it, where they need it.

[8]HBR, 'Giving Patients an Active Role in Their Health Care'
[9]PWC, 'The empowered consumer'

Philips and AI in healthcare

Adaptive intelligence combines artificial intelligence and other technologies with knowledge of the clinical and operational context in which they are used.

For healthcare IT leaders, there is much to gain from the insights, recommendations and operational support that AI promises. With more and more data being collected in hospitals – from new medical devices and equipment – and rising expectations from patients around their healthcare needs, the case for AI adoption is compelling.

However, successfully harnessing the power of AI requires more than technology alone. It is just as important to focus on the integration of AI into clinical and hospital workflows. AI-enabled solutions also need to be designed and implemented in a way that gains the trust and acceptance of healthcare professionals, building on their knowledge and experience.

That's why the true power of AI can only be realized by working hand in glove with healthcare professionals. The successful application of AI requires knowledge of the clinical and operational context in which it is used, and should involve seamless integration with other technologies as well.

Our Solution

Philips Illumeo is an imaging and informatics technology, developed in partnership with radiologists. It uses adaptive intelligence to pull data from various hospital sources to present a holistic view of the patient and provide diagnostic tools which adapt to physician needs.

An adaptive future

Philips calls this approach *adaptive* intelligence. It employs AI, but puts the healthcare provider front and center. The focus is not on automation, but on augmentation. The goal is to develop integrated solutions that adapt to the needs of healthcare providers and that are embedded into their workflows.

Integrating AI into clinical workflows should start with the end user in mind. For example, from a human interaction perspective, a lot of thought is required to find the correct approach to enable the combination of a person and AI to be better than either of them could be separately. Getting this right requires extensive collaboration between clinicians, data scientists, interaction designers, and other experts[10].

Understanding what clinicians want

AI will only be effective if it is deployed within a well-defined context, which is something that Philips understands extremely well. Developing AI-enabled solutions for a clinical setting requires a deep intimacy of clinical care. Philips creates solutions in close collaboration with clinical partners, in the process developing a thorough understanding of what the clinical needs are, and how departmental and hospital workflows operate.

This level of understanding is the only way to successfully develop and implement solutions that fit seamlessly into existing workflows. Philips has close proximity to patients and their needs: from smart devices that create or gather the medical images and data, and consoles and viewing stations that translate that data into relevant information and insights for healthcare professionals, the tools for managing cohorts of patients and the systems that interact with the patient.

[10]Auntminnie.com, 'Self-driving doctors? Auto industry offers model for AI use'

Our Solution

Philips IntelliVue Guardian System with Early Warning Scoring (EWS) aids in identifying subtle signs of deterioration in a general floor patient's condition at the point of care, helping to reduce ICU transfers and readmissions, and adverse events.

Delivering insights to support quality care

The viability of AI-enabled solutions in healthcare depends critically on having quality data in a form that can be easily processed. With high volumes of unstructured data in hospital IT systems, it isn't delivering the insights that can support operational goals and care outcomes. This is what Philips HealthSuite Insights helps to make possible.

The Philips HealthSuite Insights platform offers a set of tools and technologies to address the advancing adoption of analytics and artificial intelligence in healthcare. The platform addresses the complete 'end to end' process of analytics and AI asset creation, deployment, and support. With the Philips HealthSuite Digital Platform, a technological infrastructure that has been specifically designed for healthcare, these platforms lay a foundation for an open and secure ecosystem of AI-enabled solutions.

Focusing on data protection

Even when AI and data science projects work, technically the biggest hurdle is in the last mile. That is getting users to trust and accept the guidance from the system in how they do their day-to-day jobs. Where KPIs and performance bonuses are involved, people are naturally extremely reluctant to accept guidance from something that they do not trust. There needs to be an understanding of what happens in between data input and output so clinicians can explain the decisions made regarding diagnostic outcomes or treatment[11].

The mission to explain AI and improve patient understanding should be an imperative alongside technological progress as the public's trust is paramount to wider adoption in healthcare[12]. Recent history shows how quickly trust can be impeded by a lack of transparency in patient data usage[13] and awareness around data protection has grown with increasing cyber threats on healthcare systems. Handling increasing amounts of health-related data, one of the most sensitive types of personal data, requires increasingly high levels of assurance for patients.

[11]AI Business
[12]Future Health Index, 'Can we convince patients to trust AI?'
[13]New Scientist, 'Google DeepMind NHS data deal was 'legally inappropriate'

AI offers a unique opportunity to make sense out of data to enable fully integrated healthcare that is more predictive and precise.

Beyond the barriers

There are barriers to wider adoption of AI in healthcare. On the infrastructure side, the most challenging of them is the highly fragmented healthcare IT landscape, where data is stored in siloes and software systems are often not interoperable. AI can only be fully realized with access to large quantities of clean and structured data, with appropriate patient privacy protection and a secure, open and interoperable system which enables data integration at scale.

With those elements in place, the potential of AI to improve healthcare delivery is limitless. It offers a unique opportunity to make sense out of data to enable fully integrated healthcare that is more predictive and precise. Getting all aspects of AI-enabled solutions right requires extensive collaboration between clinicians, data scientists, interaction designers, and other experts.

When its potential is fully realized AI will support healthcare IT leaders' drive for operational efficiency and create value from the large volumes of data sitting in hospital IT systems, supporting clinicians and driving new models of care delivery. Through AI-enabled solutions we will be able to get additional context to health data and turn it into actionable information that can benefit clinicians and patients. It will support clinicians to select the right therapy for their patients, support confident diagnosis and deliver health services to patients outside of the hospital walls. And it will enable networked care solutions, to make healthcare accessible to more people around the world.