BEST PRACTICE MODELS FOR CLINICAL FLOW FOR PRACTICAL LABOR PURPOSE IN CLINICS AND HOSPITALS

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DECLARATION

"I, Nirel Catalina Leitman do hereby attest that I am the sole author of this thesis and that its contents are only the result of the readings and research I have done, and

that all citation from other scholars has been acknowledged."

Signature..

Date............11/30/2022....................

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ABSTRACT

This research paper is aimed at finding the best practice models for clinical flow for practical labor purpose in clinics and hospitals. In this paper I will be discussing three best practices and ways to use these practices efficiently. These practices include: improving patient flow that will impact efficiency, strategies for healthcare improvement to drive better care at lower costs, and the use of technology to reduce healthcare inequities.

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CHAPTER ONE

Introduction

1.1 Introduction

This chapter will provide information regarding the research topic of finding the best practice models for clinical flow for practical labor purpose in clinics and hospitals. In this paper I will be discussing three best practices and ways to use these practices efficiently. These practices include: improving patient flow that will impact efficiency, strategies for healthcare improvement to drive better care at lower costs, and the use of technology to reduce healthcare inequities.

A best practice is more than practice based on evidence. This really represents the quality care which is believed optimal. Best practices in general are health practices, methods, interventions, procedures or techniques based on high-quality evidence in order to obtain improved patient and health outcomes. When considering best practices, evince by itself is not sufficient enough to ensure evidence-based decision making but does require and uptake and sustained implementation of the evidence itself (Ham-Baloyi, Minnie, van der Walt, 2020).

Within the industry, healthcare is one of the fastest-growing sectors, driven by the enactment of complex and dynamic processes targeting optimal patient outcomes and always seeking increased effectiveness and efficiency (Pufahl, Weber & Weber, Zerbato, 2022). In order to face this growing demand for assistance and technological innovation,

care providers and other healthcare workers are increasingly resorting to various best practices in order to methodically analyze and reshape their processes and streamline care delivery, reduce costs, and at the same time increase quality.

Best practices comprise recent, relevant, and helpful nursing/doctors/management, etc. practices, methods, interventions, procedures or techniques based on high-quality evidence. In general, best practices should be applied in order to improve individual patients' health outcomes as well as the overall quality of health care and to be able to strengthen the health system at large (Ham-Baloyi, Minnie, van der Walt, 2020). This research paper will go into detail on each of the three best practices listed above. The overall research paper is outlined with five distinctive chapters. These chapters consist of: the introduction, literature review, methodology, findings and results, and lastly summary, conclusions and recommendations.

1.2 Background of the study

Healthcare focuses on many activities and outcomes through a health system. This can range from emergency department admissions and procedures to billing and discharge. COVID-19 has brought a lot of uncertainty to the world and in particular to the healthcare field. Due to this, process quality is an extremely important driver in care delivery as well as organizational success. Process improvement is also linked to better outcomes and lower costs.

The three practices I have selected to research about in this paper are to be used for healthcare process improvement and to illustrate various strategies to use. Skillsets and

advanced analytics are to be used in order to assist healthcare to continue to transform in the right direction. Healthcare process improvement is one of the essential drivers of a transformation strategy that aims to improve the quality of care while lowering costs (Health Catalyst Editors, 2022). The healthcare processes comprise of many things including: hospital admissions and discharge and billing, emergency department operations, patient transfers to different facilities, medication administration, patient flow and so much more in both the hospital and clinic settings.

Healthcare processes make major impacts on various things like: operations, patient experience, and clinician job satisfaction across the entire health system. The Health Catalyst Editors explained in their article, Healthcare Process Improvement: Six Strategies for Organization-wide Transformation that in the COVID-19 era, enhanced processes are increasingly important in the pandemic response and recovery and in continuing to deliver care to non-COVID-19 patients. With this in mind, there is an ongoing data-driven healthcare process improvement that is an essential goal for health systems to commit to better care but at the same time at lower costs (Health Catalyst Editors, 2022).

Globally evidence-based products such as best practice guidelines or standards are developed and made available, but the challenge remains to get evidence implemented and then rolled-out into everyday practice and clinical decision making (Ham-Baloyi, Minnie, van der Walt, 2020). Rolling-out involves the active distributing of best practice and knowledge about an involvement and application of this intervention in every relevant available care setting in order to provide more patients with evidence-informed care. Roll-out of the best practices will further require a point when evidence is accepted by most individuals and

cannot be turned back and therefore change is unavoidable also called the tipping point. In order to create a tipping point towards a successful adoption, implementation and roll-out of evidence and to ensure that innovations like the best practices in the health system are rolled-out, certain facilitators are required (Ham-Baloyi, Minnie, van der Walt, 2020).

Best practices are naturally adopted in the absence of efforts to push them into practice. IT in healthcare has become a critical element of fulfilling the need for support systems but it is diffusing slowly. Ensuring that every patient receives the very best care can sometimes be daunting to achieve, when doing the right thing every time may seem impossible during the busy daily life of providers. When confronted with the challenge of staying current on the latest knowledge from one's areas of expertise (which delays of months if not years in conferences and journals), complying with external measurement and practice requirements and understanding the protocols of the local facility, it is easier to understand why the traditional diffusion of best practices is a long-term endeavor (Dankbar, Dilling, Donahoe-Anshus, Hoover, Mueller, Murad, Swensen, 2013).

The Mayo clinic stated in their journal that by establishing clearly defined measures of success is a critical element of success for every best-practice project. These measures typically take the form of process compliance and outcome metrics to ensure that the practice is achieving the desired goal. After the new practice is firmly entrenched, which requires an average of 18 months, it is critical to have a mechanism to revisit the practice periodically to ensure that it is current and relevant. The Mayo clinic assigns long-term best-practice owners (typically, the physician leader of the diffusion effort) to monitor the literature, to review the metrics on a regular basis, and to generally stay informed on other

activities that may warrant changes to the best practice. These long-term best-practice owners have the authority to modify the practice in small ways or to reconstitute a Value Creation Team, if necessary, to update the practice (Dankbar, Dilling, Donahoe-Anshus, Hoover, Mueller, Murad, Swensen, 2013).

When we look at the healthcare industry, we will always find new technology being used to fight illness, develop new vaccines and medicines, and even helping people live healthier lives. Technology is one of the best practices I will be discussing in further detail in this paper. As stated by Bernard Marr in his article, 'The Five Biggest Healthcare Tech Trends In 2022', over the last two years, many tech companies have focused on applying their expertise to solve problem caused by the global pandemic. At the same time, many healthcare companies that would not necessarily have traditionally been considered tech companies have turned their attention to technology and its potential to transform the delivery of their products and services (Marr, 2022).

Due to COVID-19, many healthcare industries have looked at accelerating their technology use and according to the HIMSS Future of Healthcare Report, 80% of healthcare providers plan to increase investment in technology and digital solutions over the next five years (HIMSS, 2021). There will be continued growth in the areas including: telemedicine, personalized medicine, genomics, and wearables, with organizers leveraging artificial intelligence (AI), cloud computing, extender reality (XR), and the internet of things (IoT) to develop and deliver new treatments and services (Marr, 2022). Besides technology we will also be discussing improving patient flow that will impact efficiency and healthcare process improvement that drive better care at lower costs. Improving clinician/patient workflow

comes hand-in-hand with technology and in particular with EHRs or electronic health records. There are many strategies I will be discussing to drive better care at lower costs through healthcare process improvement and will demonstrate the impact of efficient, effective processes and the vital role of data and analytics-based methodology and culture committed to advancing care (Health Catalyst Editors, 2022).

1.3 Statement of the problem

The purpose of this research paper is to develop and review a guide for an operational plan in order to facilitate the best practices in healthcare organizations. The research problem is focused on finding the best practice models for clinical flow for practical labor purpose in clinics and hospitals. There are many good practices to follow but for the sake of this research paper I have chosen what I believe to be the top three best practices from my research findings. Each practice listed below will be discussed in more detail in this paper. These practices include: improving patient flow that will impact efficiency, strategies for healthcare improvement to drive better care at lower costs, and the use of technology to reduce healthcare inequities.

1.4 Objectives of the study

The main objective of this study is to find better ways to improve the healthcare processes and drive better care while demonstrating the impact of efficient, effective and vital role of a data and analytics-based methodology and culture committed to advancing

care. Please keep in mind that these three practices aren't numbered by importance but just numbered as a list. The first-best practice is improving patient flow that will impact efficiency. This practice will be discussed in ten strategies. The first five strategies consist of: share capacity data and ensure the patients arrive or can be transferred to places with sufficient capacity to take care of them, coordinate the arrival and discharge of patients undergoing elective procedures, establish timely discharge in the morning hours, improve hospital layout for easy navigation, and form a patient flow team for quality improvement. The last five strategies consist of: gain executive support and direction for improving patient flow, explore different staffing models, set goals with attention to patient acuity, highly-train staff on time management, and utilize advanced data analytics (Richards, 2021).

The second-best practice is the healthcare process improvement that drives better care at lower costs. This practice will be explained in six strategies. The first strategy will discuss transforming the delivery of care in the Emergency Department. The second strategy is adopting the six lean methodologies for Healthcare Improvement. The third is to improve the hospital patient flow with machine learning. The fourth is the prevention of medication errors. The fifth is to reduce unwanted variation in healthcare. And last, sixth, is to prioritize process measures over outcome measures (Health Catalyst Editors, 2022).

The third-best practice is using technology to reduce healthcare inequities. This is one of the biggest practices used in healthcare today. This practice will be explained in many different forms including: electronic health records, 3D printing, virtual reality, remote healthcare (ex: telemedicine), and artificial intelligence in healthcare. This will continue with

digital twins (creating models informed by real-world data that can be used to simulate any system or process), as well as simulations, personalized medicine and genomics.

1.5 Limitation of the study

Globally evidence-based products such as best practice guidelines or standards are developed and made available, but the challenge remains to get evidence implemented and then rolled-out into everyday practice and clinical decision making (Ham-Baloyi, Minnie, van der Walt, 2020).   There are various barriers to the implementation and roll-out of best practices that have been reported.   These barriers consist of the complexity of practice environments, the lack of support of management and buy-in, resistance to change, and the suitability of the best practice for an individual patient.   Additionally, modifying best practices to the needs and preferences of diverse populations requires further research and testing before rolling out and scaling up the best practice in a specific institution (Ham-Baloyi, Minnie, van der Walt, 2020).

The roll-out of best practice remains challenging as developed best practices might remain inaccessible and unidentified for use.   This challenge coupled with relative factors creating barriers for implementation and roll-out, results in the best practice not being implemented and rolled-out and therefore practice is not changed.   A guide, where these factors in the form of benefit levers are considered, could benefit organizations or departments to grow an operational plan that enables the roll-out of best practices in a certain context.   An operational plan can be regarded as part of a strategic plan specifying how to operate in practice to implement actions and monitor plans.   It will also define what

the organizations' human; financial and other capacity requirements are and how to involve these resources. The operational plan could enhance the roll-out of best practices to improve patients' and health outcomes (Ham-Baloyi, Minnie, van der Walt, 2020).

Some limitations of this study can cause some practices to lag behind compared to other practices. This can be partially explained by the essential intricacy of healthcare processes, the highly regulated hospital/clinic environments, and the relatively slow adoption of IT technologies, which will contribute to an increased modeling complexity (Pufahl, Weber & Weber, Zerbato, 2022). In the article, 'BPMN in healthcare: Challenges and best practices', the authors state that they define a healthcare process as "a set of medical and organizational activities that are performed in coordination to provide medical care for one or more patients" (Pufahl, Weber & Weber, Zerbato, 2022). Healthcare as a whole have specific characteristics that pose unique modeling challenges. Some of these modeling challenges are specified as: patient-centered, time-critical, decision-intensive, multidisciplinary and resource-intensive.

The modeling challenge patient-centered can be defined as the key entity on which activities are executed is usually not a document or an item. This is a patient, a human being. He or she needs to be actively involved in medical decision-making and therapeutic activities and may require individualized care (Pufahl, Weber & Weber, Zerbato, 2022). Time-critical is defined as the diagnostic and treatment processes need to be scheduled based on patient conditions, resource availability, and hospital regulations, and need to respect several time constraints (Pufahl, Weber & Weber, Zerbato, 2022). Decision-intensive is defined as decision-making that builds upon medical knowledge and requires

health workers to consider clinical evidence and available patient information. This kind of information is stored not only in IT systems but also in paper documents as well as medical devices which in turn complicates the understanding and automation of informational exchange and transformational tasks (Pufahl, Weber & Weber, Zerbato, 2022).

The last two modeling challenges stated in the above paragraphs are multidisciplinary and resource-intensive. Multidisciplinary is defined as providing the best possible treatment for a patient, different medical disciplines and organizational units needs to be integrated and coordinated (Pufahl, Weber & Weber, Zerbato, 2022). Resource-intensive is defined as medical specialists, equipment, and rooms that are usually scarce and expensive resources, shared among different departments and, thus, need to be properly managed and optimized (Pufahl, Weber & Weber, Zerbato, 2022). For all the reasons listed above, the authors in the article 'BPMN in healthcare: Challenges and best practices' state that they advocate that healthcare process modeling tasks require systematic guidance in terms of modeling tools and methods, especially to support shared understanding by different stakeholders (Pufahl, Weber & Weber, Zerbato, 2022).

Diffusion of strong evidence-based practices in the healthcare system in the United States is unfortunately measured in decades instead of months. As stated in the article, 'Accelerating the Use of Best Practices: The Mayo Clinic Model of Diffusion', the challenge of moving translational research to the bedside has challenged health care organizations for years. The ability to consistently bring innovations and best practices to scale across the entire system will be a hallmark of the successful healthcare organizations of the future (Dankbar, Dilling, Donahoe-Anshus, Hoover, Mueller, Murad, Swensen, 2013). Mayo Clinic

has also emphasized that it is best to push best practices to all sites including hospitals and clinics and to spread these practices to these facilities by promoting implementation of these best practices. Although this would be ideal, this can be insufficient as the time and resources that are necessary to formally create projects in order to spread these new practices is not sustainable. When trying to transform to an integrated delivery system across multiple sites, a new more spontaneous approach is required (Dankbar, Dilling, Donahoe-Anshus, Hoover, Mueller, Murad, Swensen, 2013).

CHAPTER TWO

Theoretical Framework and Literature Review

2.1 Introduction

This chapter introduces the theories on best practices to use in a medical setting through hospitals and clinics. Literature reviews and articles were obtained during this research paper in order to permit the student to understand the research topic on best practices to use. This section of the research paper will look at what has already been presented in other published research papers and literature reviews relevant to topic of interest. It will also look at how the various best practice ideas are related among all the research papers and literature reviews as well as the key issues surrounding the topic.

Before we discuss the framework and literature review related to the topic of best practices in the medical field, I would like to explain the approach to the literature reviews. A literature review is defined as a literature review surveys books, scholarly articles, and any other sources relevant to a particular issue, area of research, or theory, and by doing so, provides a description, summary, and critical evaluation of these works in relation to the research problem being investigated. Literature reviews are designed to provide an overview of sources you have explored while researching a particular topic and to demonstrate to your readers how your research fits within a larger field of study (Fink, 2014).

2.2 The theory of Business Process Management (BPM)

The use of process models in healthcare brings many benefits. The three main benefits will be explained further in this paragraph. The main benefit is graphical representations of processes that serve as an intuitive and more immediate reference for training and communicating with health professionals as they are easier to grasp and less vague than textual documents (Pufahl, Weber & Weber, Zerbato, 2022). The second benefit includes supporting the standardization of clinical procedures and decision-making, which in turns fosters compliance with shared protocols and minimizes variability. And the last benefit, this type of process model allows for different kinds of process analyses and can serve as a blueprint for the automation of clinical and organizational activities and information flows (Pufahl, Weber & Weber, Zerbato, 2022).

The leading standard for process modeling is the Business Process Model and Notation (BPMN) which is overseen by the Object Management Group (OMG) which features a graphical notation aimed to be "readily understandable by all business users" (Pufahl, Weber & Weber, Zerbato, 2022). BPMN allows defining process diagrams at different levels of concept which can help in the use of documentation purposes and support implementation efforts. BPMN is supported by a wide range of modeling tools and benefits from the availability of professional and academic training opportunities. BPMN can be complemented by other OMG standards such as Decision Model and Notation (DMN), which is used to capture information and decision-making aspects typical of healthcare domains (Pufahl, Weber & Weber, Zerbato, 2022).

The Business Process Model and Notation (BPMN) and the Decision Model and Notation (DMN) are among the most widespread process and decision modeling languages. They aim to provide highly understandable models for business users, which can also be used for implementation purposes. Based on the modeling goal, process models exhibit different levels of abstraction with regard to the underlying business process. On an organizational level, the high-level textual description of a process including the process inputs, outputs, and responsibilities are given. An operational process model captures activities, their relation as well as organizational information. The operational level is sub-divided by BPMN, in descriptive models, for a high-level documentation, and analytical models, to analyze the process in detail. Based on this, an implemented process model extends and adapts it with technical aspects needed for the implementation (Pufahl, Weber & Weber, Zerbato, 2022).

This next part will show a clinical example of using both standards and focuses more on BPMN. Below will show a simplified version of an emergency care process which is triggered by a worsening of patient's conditions. In the example below, it starts as the physician assessing the condition of a patient. While the physician is performing the exam on the patient, the nurse draws blood from the patient. The blood sample is sent to the laboratory for analysis and once these results are ready it is sent back to the emergency department (Pufahl, Weber & Weber, Zerbato, 2022).

Once this is received, the notes from the examination as well as the blood analysis allows the physician to make a diagnosis. Based on these results, a surgical intervention is either immediately performed by the physician or it is planned for the following days by the

nurse, keeping in mind that the patient may also refuse to undergo surgery. In all cases, the

patient is discharged while being provided with discharge documents. BPMN diagrams can

represent the control flow, data flow, and organizational aspects of a process with the

following concepts (Pufahl, Weber & Weber, Zerbato, 2022).
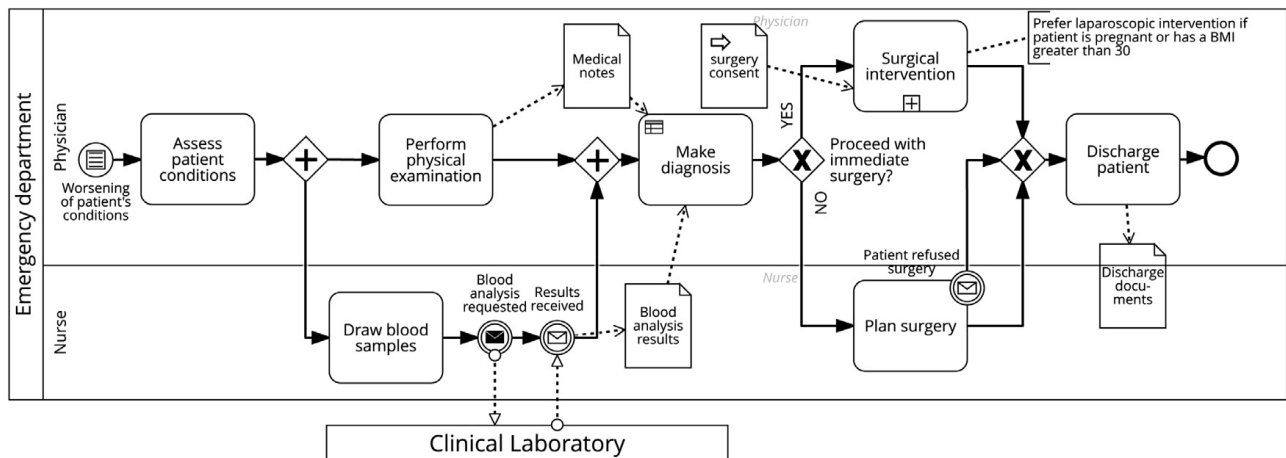
 The diagram above is a simplified emergency care process shown as a BPMN process

diagram.

 The following concepts that were stated above are as follows (these were taken

directly from the article 'BPMN in healthcare: Challenges and best practices by Luis Pufahl,

Barbara Weber, Ingo Weber, and Francesca Zerbato):

• BPMN process diagrams can represent the control flow of a

process with activities (e.g., Perform physical examination),

relevant events (e.g., Receive results), and sequence flows

connecting them. Gateways, which depicted as diamonds,

are used to control sequence flows and to define parallel and

alternative behaviors.

• Activities can be atomic (tasks) or compound (subprocesses).

Tasks (e.g., Perform physical examination) represent

atomic units of work, while sub-processes represent

compound activities, which can be collapsed to hide details

(e.g., Surgical intervention). BPMN features different types

of tasks having different inherent behavior. For example,

business rule tasks are used to represent decision-making

tasks (e.g., task Make diagnosis). Such a task can be linked to

a DMN model, which captures the decision logic, i.e., how

to make the decision.

• Relevant external events are shown as BPMN events (e.g.

Worsening of patient's conditions), which capture process

triggers to which the process reacts such as messages, signals,

conditions (e.g., Worsening of patient's conditions, exceptions

(e.g., Patient refused surgery), and outputs produced

by the process (e.g., Blood analysis requested).

• Relevant data and documents used or produced by process

activities can be represented with the help of data objects

(e.g., medical notes) or data stores when the considered

data is persistent. Text annotations can be attached to control

flow elements to enhance their description, such as

the annotation ''Prefer laparoscopic [...]'' associated with the

sub-process Surgical intervention.

• Interactions between organizations can be shown through

the concept of pools (each one owning a process) (e.g., the

Emergency department and the clinical laboratory) and a message

flow between them.

• Lanes in pools (e.g., the Nurse and Physician) can be used to

represent different roles or systems executing the included

activities.

2.3 Challenges of the theory of Business Process Management (BPMN)

There were many challenges found during this research. The authors explain that they were interested in challenges having practical implications for healthcare process modeling, they considered real process modeling initiatives as their primary data source. Their focus was on modeling challenges concerning internal healthcare processes to understand, analyze, compare, or even redesign the healthcare process as a first step of digital transformation. Once they completed their research, they came up with a list of ten candidate challenges, each of them having either one or multiple solutions (Pufahl, Weber & Weber, Zerbato, 2022).

Table 1

Summary of healthcare process elicitation and modeling projects used as a source for the challenges along with information concerning the total number of process models (column #PM) and activities (column #Act) designed during the project.

Main process	Department	Country	#PM	#Act	Project goal
Admission of patients for an elective surgery	Center for musculoskeletal surgery	DE	1	17	Process design and analysis
Management of catheter-related bloodstream infections	Intensive care	ES	14	217	Process analysis for evaluating adherence to clinical pathways and supporting decision-making [51,60]
Emergency care	Trauma emergency	DE	3	42	Process evaluation
Endoscopic procedure	Gastroenterology	DE	4	68	Process comparison of different sites
Pre-surgical consultation	Trauma center	DE	4	29	Process design and analysis
Pre-surgical consultation	Center for musculoskeletal surgery	DE	4	41	Process design and analysis
Management of chronic obstructive pulmonary disease (COPD)	Internal medicine, Primary care, ER	IT	3	104	Process design and analysis for standardization and improvement [29,30]
Elective surgery	Surgery	NL	5	67	Process redesign

Besides the challenges listed above, the authors of this article also state that they found a few other challenges that included: collaboration with external care providers, the media break (scanning and printing out documents at several points of the healthcare process), the education of medical students, and the visualization of critical clinical documents, which, could be easily realized with BPMN data objects. Whereas the latter three were reported only once, the first one is relevant to consider. Cross-organizational patterns need additional modeling concepts and will also encompass a number of patterns, such that the authors decided to leave cross-organizational challenges out of scope and, thus, they did not include collaboration with external care providers among their candidate challenges. Based on this analysis, they concluded that they identified a set of relevant modeling challenges for internal healthcare processes (Pufahl, Weber & Weber, Zerbato, 2022).
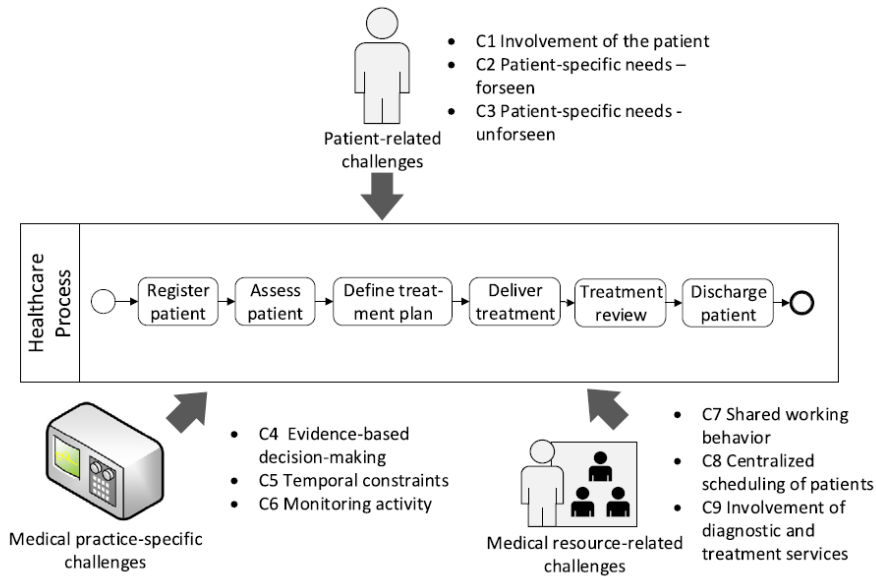
Fig. 5. Overview of common challenges arising when modeling healthcare processes in BPMN.

2.4 Literature review

Tailoring best practices in the medical field to the specific needs and preferences of diverse populations require further research and testing before these best practices can be used in specific institutions (Ham-Baloyi, Minnie, van der Walt, 2020). In order to create these best practices, this first involves disseminating the best practices and knowledge about an intervention and implementation of an intervention in every relevant available care setting in order to provide more patients with evidence-informed care (Ham-Baloyi, Minnie, van der Walt, 2020).

In the article 'Improving healthcare: a guide to roll-out best practices', the authors discuss a "Evidence Informed Model of Care" which was developed by Edwards and Grinspun has been supported by evidence and follows four facilitators for the benefit levers which include: alignment, permeation plans, leadership change and reinforcing and supporting structures. The first facilitator involves alignment which implies alignment among

stakeholders (personal alignment), between top management, middle management and government (organizational alignment), and with the external environment, financial incentives, regulations and public reporting professional norms (contextual alignment). The second permeation plan, permeation, includes three phases: 1) preparing the roll-out of best practices; 2) developing the plan; and 3) executing the plan.

The third facilitator is leadership for change and includes the following characteristics such as leadership types, leadership strategies, the position of leadership, the attitude of the leader and support for the leader in the organization. The final facilitator is supporting and reinforcing structures include various requirements such as: resources, time, education, communication, feedback and evaluation about the best practice. According to the model, roll-out of best practices occurs at certain levels in organizations and systems, such as individual level (the health professional in the unit of the organization), management level (the unit and the healthcare organizations at large), provincial level (such as the provincial Departments of Health) and national level (such as the National Departments of Health) (Ham-Baloyi, Minnie, van der Walt, 2020).

The study above acknowledges that roll-out of best practices can be done at a larger scale at different levels in the health system as well as at a smaller scale within organizations. For standardization of nursing practice and the positive impact a best practice can make on patient-, nursing- and health outcomes, roll-out of best practices at a larger scale is recommended. The developed guide that was presented in this article included the benefit levers because they were useful in the roll-out of best practices at small and large scales. The importance of the benefit levers according to the article and their role in the roll-

out of best practices was confirmed by literature reports. The importance for the roll-out of best practices to get buy-in from all stakeholders at all levels has been supported by the Agency for Healthcare Research and Quality. Leadership is required at all levels of the health system to roll-out best practices (Ham-Baloyi, Minnie, van der Walt, 2020).

Different studies confirmed in the research paper discussed above that the required leadership characteristic include the ability of the leader to teach, good communication skills, be well-trained, and being passionate or driven about changing practice. The importance of the motivating, convincing and advisory role of the leader was also mentioned by other researchers as further characteristics required by leadership. Supporting and reinforcing structures such as resources, including policies, infrastructure and staff was found to be crucial by Edwards and Grinspun's study in order to roll-out best practices. The guide can be used and adapted by various managers in healthcare organizations and departments that wish to implement and roll-out best practices. Managers who wish to roll-out best practices in their healthcare organizations, according to this article, should plan substantial time for the preparation of the roll-out, including conducting a context analysis of what is required to roll-out the best practice(s) in the specific organization. Evaluating and documenting the costs and cost-effectiveness of the best practice(s) should also be done to budget for rolling-out the best practice(s) (Ham-Baloyi, Minnie, van der Walt, 2020).

A Logic Model Is another model these authors have created in their research paper. According to these authors, a Logic Model is a systematic and visual way of presenting and sharing an understanding of the relationships among the resources required to operate a certain program, the activities planned, and the changes or results expected to achieve the

change. Logic Models can be used for program planning and design, such as a program to

implement and roll-out a best practice. The Logic Model has four steps which include: Step

1: Preparation for the development of the Logic Model; Step 2: Development and assembling

information; Step 3: Creation of the Logic Model; and Step 4: Reviewing and revising the

logic model. A description and application of these steps in order to develop the guide is

outlined in the table below (Ham-Baloyi, Minnie, van der Walt, 2020).

Table 1

The steps of the Logic Model applied to the guide[13,14]

Steps of the Logic Model	Application of the steps for the guide
Step 1: Preparation for the development of the Logic Model. Consider: • The type of stakeholders who should be involved (such as program staff, board members, funders) • Decision making (and who has decision making power) • Resources • The scope of the program/logic model	Based on the findings of an integrative literature review and interviews with stakeholders involved in the implementation and roll-out of a best practice: • Stake-holders and decision making: leaders (who are decision makers) from all levels of the health system should be involved in the development of the operational plan • Resources: Pre-implementation/roll-out of best practices: existing resources and structures should be analysed • Scope: developing a guide which can help to create an operational plan for the use of benefit levers in the roll-out of best practices in organizations and departments
Step 2: Development and assembling information During assembling and developing the following should be considered: • Resources • Activities • Outputs • Outcomes • Impact Outcomes can involve individual, community, systematic, organizational, and short-term, mid-term, and long-term outcomes	The following aspects were included: • Resources/inputs • Activities (pre-, during, and post roll-out) • Outputs • Outcomes • Impact Findings identified per benefit lever were included, as well as the levels responsible for carrying out the activities

Step 3: Creation of the Logic Model	
The determination of the scope of logic model: • What should be included and described (content) and the depth (scope) • The layout of the model (e.g. a chart form with arrows and lines showing connectedness of the components)	• Content and scope: the interviews determined the scope and content of the guide such as the specific levels and activities pre-, during and post-implementation and rollout of best practices, using Edwards and Grinspun's benefit levers as a framework • Layout: Word-document with a model outlining a summary of the guide using rectangles connected by arrows
Step 4: Reviewing and revising the Logic Model The Logic Model should be reviewed to determine whether all relevant aspects such as short and long-term outcomes and objectives have been included; whether the model is logical, and; whether the layout is appropriate	The draft guide was reviewed using an expert panel (see phase 2) Revision of the guide should be done at least annually

The Logic Model mentioned above was found to be a reasonable format for the development for a guide for an operational plan, as well as the inclusion of benefit levers at different levels of the health system. This guide could be used by managers, organizations and departments to assist in developing an operational plan. This guide requires further adaptation and testing before it can be used in other contexts. Once contextualized, the guide may have an impact on improved health outcomes for individual patients, improved overall quality of healthcare, as well as the strengthening of the health system at large (Ham-Baloyi, Minnie, van der Walt, 2020).

In this thesis paper, I have chosen the top three best practices that I believe would be the best practices model for clinical flow in clinics and hospitals for practical labor purpose. These three choices include: improving patient flow that will impact efficiency, strategies for healthcare improvement to drive better care at lower costs, and the use of technology to reduce healthcare inequities. In the next couple paragraphs, I will be explaining the importance of these best practices and why they were selected as my top three choices.

I will start with the first best practice: improving patient flow that will impact efficiency. First, we need to discuss what patient flow is. From Tim Richard's article, "17 Tips to Improve Patient Flow That Will Impact Efficiency", he states that patient flow is the moving of patients within your healthcare facility. It involves medical care, resources, decision-making, and internal systems in place. Optimizing patient flow is critical for healthcare facilities for two main reasons: patient safety and quality of care (Richards, 2021).

Improving patient flow is a way to increase revenue and patient satisfaction. Several hospitals and health systems are pursuing strategies to improve patient flow. The efficient patient flow will increase your healthcare facilities' revenue and, more importantly, keep your patients satisfied and safer. Failing to achieve the proper care at the right time can put your facility at an operational efficiency deficit. This will, in turn place your patients at risk for less than optimum care and potential harm. "Achieving hospital-wide patient flow, and ultimately improving outcomes and the experience of care for patients, requires an appreciation of the hospital as an interconnected, interdependent system of care. This, importantly, includes flow of patients within the hospital between units and departments as well as locations outside the hospital, impacting the flow of patients both into and out of the hospital. It also requires strong leadership; in fact, the role of executive leaders is critical for success" (Anderson, Kotagal, Luther, Provost, Rutherford, Taylor, 2020).

The President and Chief Executive Officer for SSM Health has stated that, "It is within our power to create a health system that invites everyone to be part of an affordable, sustainable, accessible, high-quality system that keeps people healthy and improves our communities and society at large (Kaiser, 2021). Laura Kaiser has also stated that several

lessons have been learned from the COVID-19 pandemic that health systems must apply going forward so that the industry shifts to truly creating health instead of solely treating illness. She stresses, in particular, the health at home, digital health, mental health, a healthy planet, and realigning payment incentives (Kaiser, 2021).

The second-best practice: strategies for healthcare process improvement that drive better care at lower costs. In the article, 'Healthcare Process Improvement: Six Strategies for Organization wide Transformation' they state that "Healthcare processes drive activities and outcomes across the health system, from emergency department admissions and procedures to billing and discharge. Furthermore, in the COVID-19 era's uncertainty, process quality is an increasingly important driver in care delivery and organizational success. Given this broad scope of impact, process improvement is intrinsically linked to better outcomes and lower costs. Six strategies for healthcare process improvement illustrate the roles of strategy, skillsets, culture, and advanced analytics in healthcare's continuing mission of transformations (Health Catalyst Editors, 2022).

Healthcare process improvement is defined in the Health Catalyst article as one of the essential drivers of a transformation strategy that aims to improve the quality of care while lowering costs. Healthcare processes comprise hospital admissions and discharge and billing, emergency department (ED) operations, patient transfers to different facilities, medication administration, patient flow, and more. Healthcare processes also impact operations, patient experience, and clinician job satisfaction across the health system. During the COVID-19 era, improved processes are increasingly important in this pandemic response and recovery as well as continuing to deliver care to non-COVID-19 patients. With

such a broad scope, ongoing data-driven healthcare process improvement is an essential goal for health systems committed to better care at lower costs (Health Catalyst Editors, 2022).

The third best practice: using technology to reduce healthcare inequities. In the article, 'The Five Biggest Healthcare Tech Trends In 2022', the author Bernard Marr states that, "Whenever we look in the healthcare industry, we can find new technology being used to fight illness, develop new vaccines and medicines, and help people to live healthier lives" (Marr, 2022). Marr has further explained that over the last couple of years, many of the technology companies have focused on applying their expertise in order to solve problem that have been recently caused by the pandemic. While this is normal, many other healthcare companies that normally would not consider technology companies are now considering them for Its potential transformation in order to deliver their products and services.

Due to COVID-19, this has caused the digitization of the healthcare industry to accelerate more quickly. According to the HIMSS Future of Healthcare Report, 80% of healthcare providers plan to increase investment in technology and digital solutions over the next five years (HIMSS, 2021). With this report, and the acceleration of technology in the healthcare industry, we will see a continued growth of many areas in the technology industry including: telemedicine, personalized medicine, genomics, and wearables, with organizers leveraging artificial intelligence (AI), cloud computing, extender reality (XR), and the internet of things (IoT) in order to develop and deliver new treatments and services. Bernard Marr addresses in his article that during the first months of the pandemic, the percentage of

healthcare consultation that were carried out remotely shot up from 0.1% to 43.5% (Marr, 2022).

The reasons for this increase of remote healthcare consultation are obvious but even when we take communicable diseases out of the equation, there are plenty of good reasons to develop capabilities to examine, diagnose and treat patients remotely. In remote regions and places where there are shortages of doctors (such as China and India) this trend has the potential to save lives by dramatically expanding access to medical treatment (Marr, 2022). Electronic health records or EHRs are another very valuable tool that is used for building patient trust and to improve care and communication between clinicians, providers, and patients. Electronic health records are used to help maximize productivity, enhance patient care and safety and be able to remove obstacles from current workflows (Team Altus, 2022).

According to team Altus' article, a value-based care model is becoming more popular and more clinics and hospitals optimize their electronic health records. These authors also state that a survey recently showed that 76% of larger healthcare practices are eager to make I updates in order to improve value-based programs (Team Altus, 2022). There are many benefits for using EHRs. EHRs automate the communication process by allowing clinicians and providers to access online patient data. Members of a care team in various locations are able to access data and will be able to communicate about an individual's patient's care. This type of communication can save money, and in turn, ease the burden patients and clinicians experience by avoiding duplicate tests or unnecessary treatments (Team Altus, 2022).

Online data also reduces the risk of errors that handwritten documents could result in, especially when physicians don't have a lot of time to spend detailing their handwritten notes. Improving workflows for clinicians while they are able to work with EHRs is a necessary and very helpful process. This will allow clinicians and nurses to work smoothly while they help their patients. Knowing the best practices for using EHRs in order to improve workflows in your hospital or clinic can make the difference between another technological headache for staff and a great tool they can utilize every day, especially when combined with a mobile computer workstation (Team Altus, 2022).

2.5 Conceptual framework

In healthcare, new ideas and methods allow us to treat previously incurable diseases or to make better use of scarce resources. In terms of forming a patient flow team, the article by the agency for healthcare research and quality state that 'numerous research studies have shown the importance of creating multidisciplinary teams to plan quality improvement interventions. One of the benefits of a multidisciplinary team is that members will bring different perspectives and knowledge about problems, their underlying causes, and potential solutions. These members may also be able to offer different resources and encourage buy-in for the solutions among their peers. For all these reasons, identifying the right individuals to participate in implementing the patient flow improvement strategies will be central to the success of your effort. Once formed, the team should meet on a regular basis (e.g., weekly) throughout the planning and implementation stages' (Agency for healthcare research and quality, 2018).

Below is the framework on improving patient flow. I have picked the top ten tips for improving patient flow that will impact efficiency. Later in this paper I will discuss these ten tips in further detail:

- Share capacity data and ensure the patients arrive or can be transferred to places with sufficient capacity to take care of them

- Coordinate the arrival and discharge of patients undergoing elective procedures

- Establish timely discharge in the morning hours

- Improve hospital layout for easy navigation

- Form a patient flow team for quality improvement

- Gain executive support and direction for improving patient flow

- Explore different staffing models

- Set goals with attention to patient acuity

- Highly-train staff on time management

- Utilize advanced data analytics

Below is the framework on strategies for healthcare improvement to drive better care at lower costs. I have chosen to provide six different improvement strategies and will be discussing these in more detail later in this paper.

- Transform the delivery of care in the emergency department

- Adopt the six lean methodologies for healthcare improvement

- Improve hospital patient flow with machine learning

- Prevent medication errors

- Reduce unwanted variation in healthcare

- Prioritize process measures over outcome measures

Health technologies have been and will continue to be a great way to solve global challenges that are currently being faced in the healthcare systems. Worldwide, the healthcare environment is changing due to shortage of healthcare professionals, the growth in chronic illness, and limited resources.   Using the various healthcare technologies today will improve our future and current environment. An article by the Harvard Business Review, A Framework for designing excellent virtual health care states that, 'Covid-19 has sped the adoption of virtual care, or the provision of health services remotely in a synchronous or asynchronous fashion. This is no longer just a convenient enhancement to in-person clinical care, virtual care is needed by patients, clinicians, care teams, and health systems alike' (Berry, Kaul, Offodile & Yadav, 2022).

Below is a framework used at an outpatient clinic visit at MD Anderson Cancer Center. This framework or blueprint is a comparison of the in-person and virtual processes that allows a health system to identify the elements of a care encounter that should be reproduced, removed, or enhanced in the virtual environment and this will help to plan the transition of key processes (Berry, Kaul, Offodile & Yadav, 2022).

In-person health care process

	Before the visit	During the visit	After the visit
Patient actions	• Request appointment, if needed	• Fill out patient-screening form and check in the patient	• Press Ganey survey on clinic experience
Staff actions with clinical patient contact (MA/RN/APP/MD/trainee)	• Review chart	• Peripheral nervous system/vitals (MA) • Chart review (RN) • History, exam, and treatment (APP/MD)	• Document visit in electronic medical record (MD) • Order labs, referrals (APP)
Staff actions with nonclinical patient contact (patient services coordinator)	• Schedule visit	• Check in the patient • Apply wristband • Collect copay	• Schedule labs, future studies, and follow-up visit
Technology systems actions (Epic)	• Facilitate order for visit • Deploy previsit questionnaires	• Generate copay based on insurance • Check labs, imaging results that aid decision-making	• Facilitate order entry (labs, imaging, and referrals) • Facilitate documentation in the medical record • Facilitate bill for visit

Virtual health care process

	Before the visit	**During the visit**	**After the visit**
Patient actions	• Request appointment if needed • E-register for the visit • Log in 15 minutes prior • Ensure that audiovisual devices and Wi-Fi work	• Engage with care team • Use at-home technology to recreate physical exam	• Press Ganey survey on virtual clinic experience • Correspond with care team via patient portal
Staff actions with clinical patient contact (MA/RN/APP/MD/trainee)	• Place order for virtual visit (APP/MD) • Phone prescription review (RN) • Patient teaching on telehealth platform (RN)	• Log in for visit (MD/APP/trainee/RN) • Reproduce physical exam using camera and other devices • Workarounds in case of interruption	• Document visit in electronic medical record (MD/APP) • Order labs, referrals (APP/MD)

Staff actions with nonclinical patient contact (patient services coordinator)	• Schedule visit; confirm patient's originating location is permissible under state telehealth law • Technical (audiovisual) staff call patient to troubleshoot	• Monitor for no-show • Change timing as needed if >1 hour early or late	• Schedule labs, future studies, and follow-up visit • Identify modality of the next visit (virtual or in-person)
Technology systems actions (Epic)	• Check that all relevant technologies and devices for a visit are integrated • Zoom platform allows for visit	• Check labs, imaging, and notes • Use of chatbots and algorithms for decision support	• Facilitate order entry (labs, imaging, and referrals) • Facilitate documentation in the medical record • Facilitate bill for visit

Note: APP: advanced practice provider; MA: medical assistant; MD: medical doctor; RN: registered nurse.

⛉ HBR

Source: University of Texas MD Anderson Cancer Center

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

3.1.1 Objective of this chapter

The focus of this research is to be able to find the best practices to model for clinical flow for practical labor use. Now that we have established the research question, the purpose of this particular chapter is to describe the methodology used and to analyze and interpret the data for these best three best practices.

3.1.2 Research approach and design

This particular study has been focused on by various studies but I have not seen a result that was able to focus on just top three best practices that can be used in all clinics and hospitals. I have done extensive research on multiple companies on many different best practices and have been able to combine all of my research down to three main practices that include: improving patient flow that will impact efficiency, various strategies for healthcare improvement to drive better care at lower costs, and the use of technology to reduce healthcare inequities. Now more than ever we need to focus on best practices in the healthcare field due to the number of patients that need healthcare on top of the COVID-19 pandemic.

3.2 Data analysis

3.2.1 Best practice 1

The first best practice is improving patient flow that will impact efficiency. I used primarily one main article when I found this practice. This authors name is Tim Richards and is an author for CHT Healthcare. From his extensive research on seventeen tips to improve patient flow that will impact efficiency, I selected my top ten from his list. NEJM Catalyst defines patient flow as the movement of patients through a healthcare facility. It involves the medical care, physical resources, and internal systems needed to get patients from the point of admission to the point of discharge while maintaining quality and patient/provider satisfaction.

Improving patient flow is a critical component of process management in hospitals and other healthcare facilities. NEJM Catalyst furthers states that optimizing patient flow encompasses quickly, efficiently, and effectively meeting the demand for care by moving patients through care pathways while improving coordination of care, patient safety, and health outcomes. In order to optimize patient flow, providers seek to successfully match the appropriate number of resources to each of their admission (Catalyst, 2018).

3.2.1.1 Tip 1

Tip number one from Richard states that everyone should share capacity data and ensure the patients arrive or can be transferred to places with sufficient capacity to take care of them (Richards, 2021). He goes on to say that during the worst time of the pandemic,

Boston hospitals came together to share their data and agreed to mutual aid across their systems. The president of Beth Israel Lahey Health, Tabb quoted, "At this point, I think of us all as one big hospital system. The virus doesn't respect hospital lines, it doesn't respect health care system lines, it doesn't even respect state lines. We're all in this together. That's the only way that we're going to get through it" (Bebinger & Goldberg, 2020).

Boston hospital, even traditional rivals, have launched a citywide group to manage capacity so that no one hospital becomes overwhelmed with COVID-19 patients while others have beds available. Tufts Medical Center spokesperson Brooke Hynes stated in an email, "All the Boston hospitals and their parent systems are talking daily and working together. They have all agreed to mutual aid across their systems" (Bebinger & Goldberg, 2020).

3.2.1.2 Tip 2

Tip number two states that those in the medical field should coordinate the arrival and discharge of patient undergoing elective procedures. Richards states that the pandemic had a huge impact on the medical industry that caused the slowdown of elective procedures/care and even some procedures conventionally had to be considered non-elective. He further states that elective procedures were on a slight uptick, arranging the arrival and discharge of patients that were undergoing elective procedures (timing was often under the control of the institution) could be a more effective and lasting solution (Richards, 2021). Dr. Eugene Litvak, an expert in the field of patient flow stated that greater attention to the issue of patient flow would accelerate progress toward reliable, safe, and efficient care. Dr. Eugene States that one method to optimize patient flow in hospitals is to smooth the elective surgical

schedule by spacing elective surgeries throughout the week to help alleviate strain on post-operative units instead of using block scheduling, which can lead to capacity crunches (Catalyst, 2018).

3.2.1.3 Tip 3

Tip number three states to establish timely discharge in the morning hours. Richards states that another way hospitals can attempt to relieve congestion is by discharging patient earlier in the day when appropriate (Richards, 2021). Brenda Ohta, Ph.D., senior director of care management quoted that, "leaving the hospital early in the day gives patients time to get home, get their prescription filled, and have a visiting nurse come in to see them (Richards, 2021).

3.2.1.4 Tip 4

Tip number four states to improve hospital layout for easy navigation, one way to do this is through an emergency department to increase patient throughout is to consider the layout. Richards further discusses that the layout should be made easily for the staff and patients to be able to navigate the facility and be able to complete their tasks (Richards, 2021).

3.2.1.5 Tip 5

Tip five states to form a patient flow team for quality improvement. Richards positions that there are numerous research studies that have shown the importance of creating multidisciplinary teams to plan quality improvement interventions (Richards, 2021). In an article titled, "Improving Patient Flow and Reducing Emergency Department Crowding: A Guide for Hospitals" states that one of the benefits of a multidisciplinary team is that members will bring different perspectives and knowledge about problems, their underlying causes, and potential solutions. Members may also be able to offer different resources and encourage buy-in for the solutions among their peers.

A healthcare company needs to identify the right individual in order to participate in applying the patient flow improvement strategies as this will be central to the success of the healthcare. Once a team is formed, they should meet on a regular basis like weekly or even monthly in order to thoroughly go over planning implementing various stages (Agency for Healthcare Research and Quality, 2018).

The Agency for Healthcare Research and Quality recommends that at a minimum, the team should include a team leader (day-to-day leader), senior hospital leader (example would be the chief quality officer), individuals with technical expertise related to the strategy, emergency department physicians and nurses, emergency department support staff (example would be clerks or registrars), a research/data analyst, and representatives from inpatient units. There are those personnel that often get unrecognized in the roles such as: registrars, clerks, technicians and other emergency department support personnel. It is important to note here that these unrecognized personnel are needed for these various

strategies for planning and implementing these improvements successfully. It is also very important to get the support of the chief executive officer as this person doesn't need to serve as just a system leader but needs to have some kind of verbal expression showing the support of the approval for these new resources as this shows the staff that these new strategies and resources are in fact important to the organization (Agency for Healthcare Research and Quality, 2018).

3.2.1.6 Tip 6

Tip six states that the team should gain executive support and direction for improving patient flow. Richards states that senior managers and leaders do matter and this can potentially add to the risk of harm when department heads do not support staff and hospital culture (Richards, 2021). There was an article written by Katie Sullivan from Fierce Healthcare where she writes about five ways CEOs can actually change hospital culture. Katie Sullivan intervaried a former physician named John Kenagy, M.D., founder of Kenagy & Associates. Dr. Kenagy states that hospital CEOs should focus less on talking about an organization's culture and more on the elements that make up a hospital's culture, mindset, methods, strategies, and structures. He goes on to state that health system leaders must develop adaptive concepts that support and foster a culture that can go with the flow and respond quickly to change (Sullivan, 2014).

Dr. Kenagy said that there are five successful actions of adaptive leaders, who can best align rapid front-line decision-making within employees' ranks. These five include: sets clear direction, treat people as your best resource, build trust, problem-solve flawed

processes and grow relentlessly. The first action, sets clear direction was stated to voice a clear vision of ideal patient care such as lower costs, increase in care quality and better population health. This in turn, will make the employees respond and improve when are isn't ideal. Second action, treat people as your best resource. Dr. Kenagy states, "It's the organization's ability to increase the adaptive capacity of the people and aligning those behaviors to a common purpose that leads to success," (Sullivan, 2014).

The third action is building trust. Dr. Kenagy suggests that managers should celebrate employee ideas that result in better care and treat failures as learning opportunities. This will in turn, make the employees feel safe and open to vocalize ideas and concerns (Sullivan, 2014). Fourth action is problem-solve flawed processes. This action should be used to challenge employees to change and employ processes that will drive the hospital toward ideal patient care. Fifth and last action is to grow relentlessly. Dr. Kenagy quotes that, "good managers marshal their forces when the organization stalls. Great managers opportunistically and relentlessly challenge the status quo," (Sullivan, 2014).

3.2.1.7 Tip 7

Tip seven states to explore different staffing models. There was an article written by Alexandra Pecci titled '3 ways to take control over patient flow, staffing' from health leaders where she interviewed former administrator for nursing and patient care at St. Luke's Health System in Idaho, Jennifer Mensik, PhD, RN, NEA-BC, FACHE. Dr. Mensik states that nurse leaders can, to some degree, control the flow of patients and staff if they harness unit-level

data to find trends and identify how they change staffing and routines to accommodate those trends (Pecci, 2013). Dr. Mensik quoted, "we think of staffing as static, but it shouldn't be. How can we plan better for what we know what we can be expecting?" (Pecci, 2013). She continues and says, "Nurse leaders should ask themselves; how can we staff differently to make an impact to smooth out variability?" (Pecci, 2013). When she speaks with other nurse leaders about finding ways to control variability, they don't believe her. She tells them that all it takes is some new thinking and a willingness to deviate from the status quo.

Dr. Mensik explains three strategies leader nurses can use. This includes: schedule discharges, don't forget about Pas and NPs, and revamp the surgical schedule. The first strategy is scheduling discharges. Dr. Mensik mentioned while she worked at a hospital, the staffing issues that she found had a ton of discharges in the afternoon which became really difficult. When the census dropped in the evening, they had too many nurses. In the end, the unit itself took over and fixed the problem by scheduling discharges during admissions and scheduling accordingly. She recommends using a pre-arranged discharge schedule so that discharges aren't lumped into the same window of time. When does this way, nurses know upfront who they're discharging and when, allowing them to organize their care and spend a generous amount of time with each patient (Pecci, 2013).

The second strategy is to not forget about Pas and NPs. Dr. Mensik states, "they're still very, very underutilized. Nurses don't have to wait for the physician to come around at discharge while the PA or NP can discharge patients. Nurse leaders can work with Pas and NPs ahead of time to establish discharge plans with the interdisciplinary team (Pecci, 2013).

The third strategy, revamp the surgical schedule. Dr. Mensik quotes that, "your surgical schedule is artificial. It can be manipulated to maximize staffing" (Pecci, 2013).

She continues to state that she has seen hospitals that can be at 100% capacity on Tuesdays and Wednesday and at 25% capacity on Saturday night. Dr. Mensik, "We're burning out the nurses in the middle of the week while at the same time providing the minimum number of nurses on the weekend. We can accommodate these artificial surgical surgeries" (Pecci, 2013). She acknowledges that some surgeons have a lot of influence; they like to do certain procedures on certain floors and usually they get their way. She suggests to sit down with those physicians and see what can be done about smoothing the surgery schedule (Pecci, 2013).

3.2.1.8 Tip 8

Tip eight states to set goals with attention to patient acuity. Richards explains that "patient flow standard" was published by the Joint Commission to help healthcare facilities manage their patients' flow throughout the hospital. There is a 4-hour time frame that is referenced in the Standard is used as a guideline for hospitals to use as a reasonable goal in its boarding time. An example of this would be the time when a patient is held in the emergency department to the time they are admitted or transferred (Richards, 2021). Richards continues to explain that hospitals measure and set goals for patient flow based on the following information:

- o Availability of patient beds

- The throughput of areas where patients receive care treatment and services (ex: inpatient units, laboratory, and radiology)

- The safety of areas where patients receive care, treatment, and services

- The efficiency of the non-clinical services that support patient care and treatment (ex: housekeeping and transportation)

- Access to support services (ex: case management and social work)

Overall, using data will help hospitals manage any issues that could affect their emergency department like patient boarding, leading to patient harm and quality of care (Richards, 2021).

3.2.1.9 Tip 9

Tip nine states using highly-train staff on time management. Richards explains that one of the most effective skills to have for healthcare professionals is time management. Being able to understand how to plan and control time spent on daily tasks is a crucial part to patient safety (Richards, 2021). There is an article by Casarez from a company called Continuum where he talks about the top six-time management tips for healthcare professionals. The first is establishing goals -take the time to establish goals and create a sense of purpose for your work week. Try to set goals for 30, 60, and 90 days. Once these goals are established, write them down, discuss them with the supervisor then schedule a few moments at the beginning and end of each week to review these goals, action items and progress (Casarez, 2021).

Second time management tip is to prioritize the work day. Casarez suggests that when one arrives to work to write out specific tasks that need to be completed each day and the time it will take to complete these tasks. Once you arrive at work, review the list and post it in a location that is easily visible. Throughout the day, keep re-checking this list and adjust it as needed. The third tip is taking advantage of technology. Consider getting a software technology system like CareCloud (Casarez, 2021).

CareCloud is a software is designed specifically to streamline healthcare practices by improving practice management and organizing health records. When practices are online, this allows the clinic or hospital to stay organized and saves time for both the facility as well as the patients. Using this software, there is also a mobile app that patients can use that will allow them to review their records, make appointments and be able to communicate with facility staff (Casarez, 2021). There are other types of software and technology that can help healthcare practices. All of this will help to save time so that there is more time for patient care.

Fourth tip is to ask your organization to use electronic health records. I will be discussing this and technology uses in the healthcare field in the next section. Electronic records cut down on paperwork while making it easier to find relevant patient information. The faster you can access and be able to update patient records, the more everyone can benefit from it (Casarez, 2021). Fifth tip is to delegate when possible. Try not to do everything on your own if there is extra help available. Medical assistants, administrative staff, interns, and volunteers are available and want to help so please take advantage of their help and don't carry the entire load on yourself.

The sixth tip is to know when to say no. Coworkers around you know you're busy but they still come by and ask you for help. Be realistic and know your own workload and only take on extra work if you have the time to do it. Casarez states that you may think you are improving yourself and your career by taking on every single project that comes your way, but this will be hindering you as you will become overwhelmed and no one will benefit from this. This will lead to increased stress and decreased productivity which are not goals one should strive for, so please consider the requests and know when to turn down extra work (Casarez, 2021).

Time management tips for busy hospital executives from Richards includes: sharpen your communication skills, target your time for essential responsibilities, and empower your colleagues (Richards, 2021). There is an article on Elsevier explaining important time management tips for nurses. In this article it states that nurses' mission is to deliver the highest level of care at every stage of the patient journey; a mission that requires a powerful combination of trusted evidence and technology to empower the nurses to excel (Elsevier, 2022). The three tips they have explained in this article include: orientation and retention, care coordination, and patient experience. Orientation and retention are used to support nurses with evidence-based, customized education and resources to enhance their confidence, competence, and satisfaction. By creating this culture of support, it helps promote nurses' retention and consistent, quality patient care (Elsevier, 2022).

The second tip is care coordination. This is used to help promote patient-centered, coordinated care and well-informed decisions across the care teams. When once can deliver the same high-quality standard of care at every patient touchpoint, one can protect

against costly errors, duplications and readmissions (Elsevier, 2022). The third tip is patient experience. This is used to engage, educate and empower the patients by providing the right information in the right way. By encouraging patients to become active participants in their health, one can promote better clinical and financial outcomes and a more satisfying patient experience (Elsevier, 2022).

3.2.1.10 Tip 10

Tip ten states utilize advanced data analytics. Richards explains that a big data trend in the marketplace is the increased use of analytics to advance patient safety. Valuable insights in real-time can impact patient care and safety (Richards, 2021). Richards wrote another article titled 'Big Data Healthcare Trends Will Improve Outcomes'. He continues to say that improved technology will play a pivotal role in the collection and analysis of big data for healthcare facilities. Healthcare providers will have access to large data sets to help improve their patients' overall well-being (Richards, 2018). He has discussed seven big data healthcare trends and explains how these big data analytics will drive healthcare forward.

Number one big data healthcare trends states that healthcare IoT will improve patient's health (Richards, 2018). IoT is shortened for the Internet of Things which describes the network of physical objects or things that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet (Oracle, 2022). These devices range from ordinary household objects to sophisticated industrial tools. There are more than seven billion connected IoT

devices today and experts are expecting these numbers to grow to 22 billion by 2025 (Oracle, 2022).

Number two is increased focus on patient-centric care. Richards states that, "no combination of methods, tools, and techniques is complete without the essential principle of a patient-centric focus throughout (Richards, 2018). Number three is predictive analytics reduces fraud waste and abuse. The centers for Medicare and Medicaid services prevented more than $210.7 million in healthcare fraud in one year using predictive analytics. The four types of predictive analytic models being used to detect fraud include: rules-based, anomaly, predictive, and social networking (Richards, 2018).

Number four is to build better patient profiles and predictive models. Some analysts estimate the "current of size of the personalized medicine market will reach more than $2 billion by 2022" (Richards, 2018). Number five is accelerating value and innovation in the healthcare ecosystem. These can include: right living, right care, right provider, right value, and right innovation. Number six is big data will help reduce healthcare cost. A McKinsey & Company report stated that, "after more than 20 years of steady increases, healthcare expenses now represent 17.6 percent GDP which is nearly $600 billion more than the expected benchmark for a nation of the United States' size and wealth" (Richards, 2018). Number seven states real time infection control. Richards talks about sepsis as being a major issue in the U.S. health system, it kills one person every two minutes and accounts for nearly $24 billion in annual healthcare costs (Richards, 2018).

3.2.2 Best Practice 2

The second-best practice are strategies for healthcare improvement to drive better care at lower costs. I used primarily one main article when I found this practice and this article reviews six models for these strategies. In this article, the author states that healthcare process improvement is one of the essential drivers of a transformation strategy that aims to improve the quality of care while lowering costs. The healthcare process comprises mainly with the hospital admissions and discharge and billing, emergency department operations, patient transfers to different facilities, medication administration, patient flow, and more. Healthcare process impacts operations, patient experience and clinician job satisfaction across the entire health system. It is very important to optimize processes during this pandemic time and to understand that healthcare improvement is an essential goal for health systems committed to better care at lower costs (Health Catalyst Editors, 2022).

3.2.2.1 Strategy 1

There are six strategies in this article that discuss how to drive better care at lower cost through healthcare process improvement in order to demonstrate the impact of efficient, effective processes and the vital role of a data and analytics-based methodology and culture committed to advancing care. The first of these strategies is to transform the delivery of care in the emergency department. Overcrowding in the emergency department has been associated with increases in patient mortality, length of stay, and costs for admitted patients. The emergency wait times and patient leaving without seeing a qualified medical provider

are just a few on the indicators of overcrowding. The data-driven approach addresses common drivers of emergency department overcrowding and guides the redesign or emergency care delivery. These approaches include (Health Catalyst Editors, 2022): A four-step approach to redesigning the delivery of emergency care

- o 1. Begin with the bigger aim and ask "What do we need to best deliver emergency care?" – this will improve the patient experience of care, improve health of populations and reduce the per capita cost of healthcare
- o 2. Create a vision and support for a data-driven systems approach to improve emergency care – create an emergency department Joint Practice Team which allows anyone to touch the patient and be a part of the team. This will help with communication between departments
- o 3. Using an analytics platform, develop an emergency department analytics application that provides insight into performance – using an analytics application such as ED Explorer, frontline leadership and executives have the ability to track throughput, and obtain actionable data necessary for demand/capacity management
- o 4. Engage frontline staff, key stakeholders, patients, and families in improvement – this must include the entire system of care for real, lasting change to occur

The next approach is understanding the emergency department performance. This can be done by preventing the ED (emergency department) from operating in isolation, it's necessary to involve hospital leadership and other frontline leaders in the improvement

process. One way to do this is using executive dashboards that show a snapshot of the ED performance on a regular (perhaps daily) basis. Dashboards might show the C-suite how many patients are in the ED, how many are waiting to be seen, wait times, and the number of behavioral health patients. One of the most telling metrics used in an executive dashboard is the longest wait time recorded or the longest wait time for a bed to be assigned to an admitted patient in the last 24 hours. Using executive dashboards can help keep stakeholders informed and involved. Increased leadership visibility and engagement can greatly contribute to success (Health Catalyst Editors, 2022).

The authors of this article continue stating that in addition to the daily snapshot, executives might be given access to look ED goals, past performance, patients left without being seen percentage, and admission trends. Using an emergency services application such as ED Explorer can help provide the data necessary to track, trend, and predict resources need in the delivery of quality emergency care. Moreover, a robust ED analytics application allows users to identify and quantify areas of opportunity in throughput, ancillary resource allocation, utilization, and quality. Below is a snapshot of the ED Explorer analytics application (Health Catalyst Editors, 2022).

Figure 1: Snapshot of ED Explorer analytics application that provides multiple views of data for the efficient day-to-day Emergency Department operations.

Another approach is revising high-impact workflows. Revising high impact workflows such as streamlining registration and provider triage can have real, impactful results on ED wait times, patients left without being seen percentage, and patient overall experience. Some of the workflow areas to focus on include (Health Catalyst Editors, 2022):

- o Improved triage workflow

- o Provide earlier access to provider using a triage advance practitioner

- o Redesign discharge process to reduce non-value-added time

- o Implement readiness huddles

- Improve response to surges in patient volumes

- Revise staffing patterns

- Add flow coordinator during busy times to oversee hospital patient flow

Revising staffing patterns is another approach where the department leaders need to ask "Do we have the right number of staff at the right times in the right places?" (Health Catalyst Editors, 2022). Hospital leaders will be surprised that ED volumes can be predictable. Using an analytics platform, healthcare leaders can gain use following insights into volumes to help inform their staffing patterns. These include (Health Catalyst Editors, 2022):

- Identify seasonality in volume trends

- Identify weeks with consistently high-volume

- Utilize this data to predict upcoming high-volume periods

- Adjust staffing matrix to meet trends

- Use historical trends to plan for holiday or other identified periods of high census

- Use trends to open and close sections of the ED to align with demand

Setting leadership expectations is crucial to the success of the ED performance. It is necessary for the leaders to be active and engaged in the department and its improvement efforts. It is also important to keep executives informed and involved through daily rounding, participation in surge calls if needed, and receiving daily ED performance reports (Health Catalyst Editors, 2022). The last approach is improving the patient experience. In order to improve patient satisfaction in the ED, the quality of care must be consistent. Hospitals must

read and respect patient feedback in order to identify the high impact areas of focus. Some

ideas for improving the patient experience in the ED include (Health Catalyst Editors, 2022):

- o Facilitate weekly huddles to review patient feedback

- o Ensure leadership makes clear that patient experience is a priority for the entire

  team

- o Exchange security FTEs for "Guest Services"

- o Conduct patient experience training

- o Consider embedded care management in the ED

- o Have leaders perform daily rounds

- o Reinforce common patient experience best practices and expectations

3.2.2.2 Strategy 2

The second strategy is to adopt the six lean methodologies for healthcare

improvement. Six Lean Sigma is a team-focused managerial approach that seek to improve

performance by eliminating waste and defects (Kenton, 2021). Kenton, author of an article

explaining what Lean Six Sigma is continues to explain that it combines Six Sigma methods

and tools and the lean manufacturing/lean enterprise philosophy, striving to eliminate waste

of physical resources, time, effort and talent while assuring quality in production and

organizational processes (Kenton, 2021).

For this strategy, by adopting these lean principles, healthcare organizations are able

to reduce waste while improving the quality of care (Health Catalyst Editors, 2022). This

particular improvement approach involves applying strict clinical data measurement to

routine care delivery, allowing health systems to be able to identify the best practice protocols and be able to incorporate those into the clinical workflow. When healthcare teams are able to use these best practices through a continuous-learning loop, they enable protocol updates and improvement throughout the organization and eventually reduce waste, lower costs, and can improve access to care (Health Catalyst Editors, 2022).

3.2.2.3 Strategy 3

The third strategy is to improve hospital patient flow with machine learning. Health systems can influence machine learning and predictive models to improve patient flow for different departments throughout their organization. Being able to improve the hospital patient flow can result in reduced patient wait times, reduced staff overtime, improve patient outcomes, and improve patient and clinician satisfaction. In the Health Catalyst article, the author states that if the healthcare system can focus on three main critical areas, this will lead to improved hospital patient flow. These three main critical areas include (Health Catalyst Editors, 2022):

- o Building a data science team
- o Creating a machine learning pipeline to aggregate all data sources
- o Forming a comprehensive leadership team to govern data

3.2.2.4 Strategy 4

The fourth strategy is to prevent medication errors. The authors of this article states that there is a potential industrywide savings of almost $21 billion and an impact on more than seven million patient lives, preventing harmful medication errors is a significant improvement opportunity for health systems (Health Catalyst Editors, 2022). There is approximately fifty percent of adverse drug events that are preventable, making their reduction a highly impactable area of process improvement. There is current data and analytics workflow tools that are working on making adverse drug events surveillance, monitoring and prevention increasingly more effective (Health Catalyst Editors, 2022).

3.2.2.5 Strategy 5

The fifth strategy is to reduce unwanted variation in healthcare. In outcomes improvement in healthcare, variation threatens quality across processes and outcomes. There are many outcomes that can be measured, anything from the change in blood pressure in patients with hypertension to patient reported outcome measures. Outcome measures are primarily defined and prioritized by national organizations, such as: CMS (Centers for Medicare & Medicaid Services), The Joint Commission, NAHQ (National Association for Healthcare Quality). The health systems target outcome measures based on state and federal government mandates, accreditation requirements, and financial incentives (Health Catalyst Editors, 2022). It is simple for health systems to improve outcomes by identifying where and how inconsistency impacts their outcomes and minimize

unwanted variation. There are three critical steps to reduce unwanted variation and these include (Health Catalyst Editors, 2022):

- o Remove obstacles to success on a communitywide level

- o Maintain open lines of communication and share lessons learned

- o Decrease the magnitude of variation

Health Catalyst further explains that there are seven groupings of outcome measures CMS uses in order to calculate hospital quality and these are the most commonly seen in healthcare. The CMS has categorized these seven measures by importance. These seven include (Health Catalyst Editors, 2022):

- o Mortality – essential population health outcome measure

- o Safety of care – measures pertain to medical mistakes. The 2 common safety of care outcome measures include: skin breakdown and hospital-acquired infections

  - o Skin breakdown = happens when pressure decreases blood flow to the skin. There is a skin assessment tool that can be used to reduce skin breakdown. Patients that have skin breakdown are at higher risk of infection. Patients' risk scores go up in their diabetic because of their poor circulation

  - o Hospital-acquired infections = caused by viral, bacterial, and fungal pathogens

- o Readmissions – following hospitalization is a common outcome measure. These are costly and can often be preventable. The University of Texas Medical Branch was able to reduce their hospital readmission rate by implementing several care coordination programs and leveraging their analytics platform and advanced analytics

applications in order to improve the accuracy and timeliness of data for informing decision making and monitoring performance.

o Patient Experience – patient reported outcome measures fall within the patient experience outcome measure category. This is used to assess the patient's experience and perception of their healthcare. This information will provide a more realistic gauge of the patients' satisfaction as well as real-time information for local service improvement and to be able to identify issues.

o Effectiveness of care – outcome measure evaluates two things: compliance with best practice care guidelines and achieved outcomes (ex: lower readmission rate for heart failure patients)

o Timeliness of care – outcome measures assess patient access to care. There is an issue with overcrowding in the emergency department and this has caused increased inpatient mortality, increased length of stay and increased costs for admitted patients. There was a community hospital that figured out how to reduce overcrowding in their hospital. This hospital used an analytics platform and used it in their emergency department. This platform focused on the emergency department data improvement in four areas: staffing patterns, registration, triage assessment by the registered nurse, and early access to a qualified medical provider.

o Efficient use of medical imaging – increasingly important outcome measure. Medical imaging is a huge role in the global healthcare system and this contributes to improved patient outcome and more cost-efficient healthcare in all major disease entities.

3.2.2.6 Strategy 6

The sixth and final strategy is to prioritize process measures over outcome measures. In the healthcare industry, it tends to prioritize outcome measures but these measures by itself won't benefit the organizations reach their goals of better quality and reduced costs. Health Catalyst state that these health systems need to get more granular with their data by tracking process measures. Process measures make it possible to identify the root cause of a health system's failures. These types of measures are like the checklists for the system guaranteeing the organization will deliver the right care to every patient, every time (Health Catalyst Editors, 2022).

Process measures are specific steps in a process that lead to either positive or negative outcome. Health Catalyst made an example of this by explaining that if the outcome measure is LOS (length of stay), the process metric for this outcome might be the amount of time that passes between when the physician ordered the discharge and when the patient was actually discharged. Another way to look at this would be to look at the turnaround time between final take-home medication being ordered and the medication delivery to the unit. In this particular scenario, if the pharmacy takes three hours to get the necessary medications to the floor, potentially delaying the discharge, you have pinpointed a concrete opportunity for the healthcare process improvement (Health Catalyst Editors, 2022).

3.2.3 Best Practice 3

The third-best practice is the use of technology to reduce healthcare inequities. There are many, many different types of technology that are being used in healthcare so for the sake of this paper, I will be discussing the top five technology that I believe will make a big impact in the healthcare industry. These top five will be: remote healthcare/ telemedicine, extended reality, artificial intelligence, Digital Twins/simulations, and 3D Printing. Technology has been used to fight various illnesses, develop new vaccines and medicines and help others with a healthier way to live. There have been more and more healthcare companies that are looking at tech companies to help transform the delivery of care through their products and services. Bernard Marr mentions in his article that the pandemic has accelerated the digitization of the healthcare industry. He states that the HIMSS (Healthcare Information and Management Systems Society) Future of Healthcare Report state that 80% of healthcare providers plan to increase investment in technology and digital solutions over the next five years (Marr, 2022).

3.2.3.1 Remote Healthcare/Telemedicine

Telemedicine has increased exponentially due to COVID-10 Pandemic that started back in 2020. Telemedicine refers particularly to the remote clinical services, while telehealth incorporates remote non-clinical services. A lot of people are finding new ways to work these days since the pandemic which shows that telemedicine will continue to be on the rise. Global telemedicine market is projected to grow from $68.36 billion to $218.49 billion by 2026 (Burke, 2022). Burke stated that more so, in 2022, the technology for virtual-

care appointments will continue to advance beyond the 1:1 doctor-patient video conferencing. A great example of this is the rise of patients needing behavior therapy for mental health illnesses. Knowing this information, we can expect to see technology that will facilitate group sessions, allowing multiple patients to be supported together (Burke, 2022).

Telemedicine is a great opportunity as it has a lot of benefits for both the provider and the patient. These benefits include comfort and convenience for the patients as well as cheaper in the long run for patients as they don't need to find costs for traveling or childcare. Another great benefit is that it can improve access for other populations such as the elderly adults, people who are geographically isolated, or even those that are not able to leave their homes. The benefits for the healthcare providers include reducing overhead expenses, lessens the exposure of illness and infections and allows the providers able to see more people as they are able to work more flexible.

An article found in the Forbes magazine by Bernard states that during the beginning of the pandemic, the percentage of the healthcare consultations that were carried out remotely shot up from 0.1% to 43.5%. The reasons for the increase are due to COVID but there are good reasons to continue virtual appointments such as developing capabilities to examine, diagnose and treat sick patients virtually. A great example of using this virtual ability is in regions that have a shortage of doctors like China and India. These remote places have a trend to save lives by dramatically expanding access to medical treatment (Marr, 2022).

Health technology is allowing people to better engage with their providers, access more care overall, and be able to access more resources in order to stay informed while taking more preventative measures. Healthcare providers are increasingly turning to remote patient monitoring and virtual visits in order to maximize access to care, strengthen connections with at-risk populations, minimize the risk of COVID-19 transmission, provide more convenient experiences and reduce the strain on scarce hospital resources. The article in the Philip website also states that while this is a positive step, according to the World Bank and World Health Organization (WHO), they state that half the world unfortunately still lacks access to quality care and without action, they believe that five billion people will be unable to access healthcare by 2030. Due to this statement, it is very important that the healthcare organizations continue to pioneer digital health technologies in order to bring care closer to patients and to keep improving access to quality healthcare for everyone no matter where they live (Philips, 2022).

Another way to deliver remote healthcare is by the use of wearable technologies that are equipped with heart rate, stress, and blood oxygen detectors and permit healthcare professionals to precisely monitor vital signs in real-time. Due to the pandemic, healthcare organizations are starting to establish "virtual hospital wards" where the central communication infrastructure is used to oversee the treatment of multiple patients all in their own homes. The Pennsylvania Center for Emergency Medicine has been developing a" virtual ER" kind of like the "virtual hospital wards" (Marr, 2022). Telemedicine has a huge potential to improve access to healthcare where half the population doesn't have that access. In order to make this happen, we have to get the public's trust and there are still some people out there that have to have in-person interactions versus virtual.

There is an article titled, "Hospitals turn to remote monitoring tools to free up beds for the sickest coronavirus patients" that further explains how they use these remote tools. These tools rely on software and smartphones in order to track patients' blood pressure, breathing, and temperature as well as the functions of the patients' lungs, heart, along with their other vital organs. This next step on remote monitoring of the patients' objective biological measures will be used more often and is the step in the right direction (Ross, 2020). Raj Khandwalla, a physician and director of digital therapeutics for the Smidt Heart Institute at Cedars-Sinai Medical Center in Los Angeles states that, "Traditional healthcare delivery is inadequate in dealing with this pandemic. We have to use a healthcare strategy that deploys resources throughout an entire community, and that's where remote monitoring come in" (Ross, 2022).

The financial and physical toll of traveling to a doctor's appointment can be avoided using telehealth. Patients can easily log on their computer in the comfort of their own home and have a one-on-one camera consultation with their physician. This in turn helps the physicians free up their agendas and permits them to treat more patients in a single day. The Co-founder and COO of Paloma Health, Marina Tarasova quotes, "I think remote tools will be the number one trend this year for delivering care. Not only is telemedicine seeing an incredible surge because of fears of virus contagion, but also a very efficient and convenient way to get care in many cases that avoid all the unnecessary parts of care like looking for parking and waiting in waiting rooms" (Tsimaraki, 2022).

3.2.3.2 Extended Reality

Extended reality is a term used to cover virtual reality (VR), augmented reality (AR), and mixed reality (MR). This different reality terminology all refer to lenses or headsets that modify our perception of the world by either placing us in virtual environments (VR) or overlaying virtual elements on real-time images of the world around us (AR/MR) (Marr, 2022). In the healthcare field, VR headsets are used to train doctors and surgeons by allowing them to get closely acquainted with the workings of the human body without needing to put patients at risk or require medical cadavers. VR is also seen and used in treatment for patients. In the therapy part of treatment, VR has been seen and used in training children with autism with their social and coping skills. This has also been used to facilitate cognitive behavioral therapy (CBT) in order to help with chronic pain, anxiety, and even schizophrenia by allowing patients to work through their fears and psychosis in a safe and non-threatening environment (Marr, 2022).

Virtual reality in the healthcare market consists of sales of virtual reality hardware and software by entities (organizations, sole traders, and partnerships) that manufacture VR technology and devices for use in the healthcare industry. Specifically, VR in the healthcare field refers to the use of immersive, computer-generated technology in medicine and treatment (Globe Newswire, 2022). The main types of components in virtual reality in the healthcare market consists of hardware and software. The hardware includes the headsets, goggles and other accessories used in the healthcare facilities for medical training, performing virtual surgeries and others to make the user feel immersed in the 3D environment (Globe Newswire, 2022). The benefits of having VR in the healthcare filed is

to make more impactful visual experiences of space and human anatomy, lowering medical costs, reducing fear and stress, decreasing traumatic events, and improving outcomes (Globe Newswire, 2022).

Globe Newswire further explains that the main technology used in VR in the healthcare field includes: full immersive virtual reality, non-immersive virtual reality, semi-immersive virtual reality and various devices such as: head-mounted display, gerture-tracking device, projectors and display units, among others. VR is used in research and diagnostics, laboratories, hospitals and clinics, pharmaceutical companies, patient care management, education and training, fitness management, pharmacy, surgery, and more (Globe Newswire, 2022). There is a rise in neurological disorders and the growth of virtual realities in the healthcare market right now. Neurological disorders are diseases such as: Alzheimer's disease, Parkinson's disease, dementia, multiple sclerosis, migraines, and other diseases that affect the body's central nervous system. Immersive VR technology assists in the development of promising applications for the treatment of neurological illnesses. VR in neurology is cost-efficient, patient-friendly, useful for both normal and pathological aging and gives ecological validity that standard neuropsychological tests do not provide (Globe Newswire, 2022).

This year, 2022, there have already seen improvements in AR in the healthcare field such as the AccuVein system. This type of system is designed to make it easier for doctors and nurses to locate veins when they need to give injections by detecting the heat signature of the blood flow and highlighting it on the patient's arm. Microsoft's HoloLens system is used in surgical theatres where this allows the surgeons to receive real-time information

about what they are seeing and at the same time being able to share their view with other professionals or even students who may be observing in the operations. There are other AR health applications for those people that are not in the medical field. An example of one of these applications is called AED4EU geo layer. This type of application provides real-time directions to the nearest publicly accessible automated defibrillator unit (Marr, 2022).

Virtual reality headsets have been around for many years but have been used for high-tech gamers. It wasn't until 2021 when VR and AR started entering the medical world. COVID-19 pandemic has had a turning point where they are seeing more and more extended reality in use. There was a market research report that estimated between 2021 and 2026 that the market of VR in the healthcare field will grow 35% annually which will equate to more than $40 billion by the end of 2026 (Park, 2021). An example of a MedTech VR and AR product in ophthalmology created by Heru from the Bascom Palmer Eye Institute is re: Vive VR based vision testing platform. This is available commercially via headsets from Microsoft and Magic Leap. Re: Vive VR performs six types of tests in a patient-administered process: looking for color blindness, contrast sensitivity, visual field deficiencies, and dark adaptation. The unit consists of a lightweight headset and wirless clicker to record patient responses. A software application can be downloaded onto a portable device like a laptop or tablet in order to review the results (Park, 2021).

Doctors are able to explore a tumor before undergoing a procedure, a medical student is able to dive into the complexities of the human body and bed-ridden or special care patients can now entertain themselves by playing VR video games, viewing comforting nature scenes or even visiting their favorite vacation spots (Tsimaraki, 2022). VR has been

seen increasingly in use in a range of psychological illnesses and conditions ranging from stress and anxiety to dementia and autism. Other ways VR is being used is for pain management by changing the patients' thoughts and perceptions around their pain. VR has been using in training processes for the medical professionals and it even allows you to be transported into the human body. The doctors are able to diagnose better and the patient is able to virtually step into a panoramic view of their own body giving them a better understating of their disease or condition. There is still a lot to understand and uncover for VR but in the medical field, they are focusing on medical advances in preventative medicine, rehabilitation, assistive living, cancer therapy and surgery (Burke, 2022).

3.2.3.3 Artificial Intelligence

Artificial intelligence (AI) is defined by the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions. AI is also applied to any machine that exhibits traits associated with a human such as learning and problem-solving (Frankenfield, 2022). The basic characteristic seen in AI include the ability to rationalize and take actions that have the best chance of achieving a specific goal (Frankenfield, 2022). In the healthcare field, AI is used in many forms such as: medication timers, speech recognition, patient follow-up alerts, and online diagnoses through chatbots just to name a few (Tsimaraki, 2022).

According to an article on a guide to artificial intelligence in the enterprise, they explain how AI works. The authors explain that AI requires a foundation of specialized hardware and software for writing and training machine learning algorithms. There is no one

programming language that is synonymous with AI but there are a few that are very popular that include: Python, R and Java (Burns, Laskowski & Tucci, 2022). AI systems work by ingesting large amounts of labeled training data, analyzing the data for correlations and patterns, and using these patterns to make predictions about future states. AI programming focuses on three cognitive skills that include: learning, reasoning and self-correction (Burns, Laskowski & Tucci, 2022).

To further explain the above paragraph, a chatbot that is fed examples of text chats can learn to produce lifelike exchanges with people, or an image recognition tool can learn to identify and describe objects in images by reviewing millions of examples (Burns, Laskowski & Tucci, 2022). Artificial intelligence has a learning process it needs to use in order to understand. AI focuses on acquiring data and creating rules for how to turn the data into actionable information. These rules are called algorithms which provide computing devices with a step-by-step instruction on how to complete a certain task (Burns, Laskowski & Tucci, 2022). Advantages of AI include: good at detail-oriented jobs, reduce time for data-heavy tasks, delivers consistent results and AI-powered virtual agents are always available. Disadvantages of AI include: expensive, requires deep technical expertise, limited supply of qualified workers to build AI tools, only knows what it's been shown and lack of ability to generalize from one task to another (Burns, Laskowski & Tucci, 2022).

In the medical field, there is a high use of AI in order to help make sense of huge amount of messy, unstructured data that's available for capture and analysis. Examples of this in the healthcare field include the form of medical image data like: X-rays, CT and MRI scans among many other sources (Marr, 2022). Marr further explains that current trends

around the use of AI involve the augmentation and upskilling of human workers. An example of this is how the surgeons work with assistance of AR – augmented by computer vision – cameras that can recognize what they are seeing and relay the information. Another main use we see in the healthcare field with AI is automating initial patient contact and triage in order to free up clinicians' time for more valuable work (Marr, 2022).

Another field of healthcare that will be greatly impacted by AI in the coming years is preventative medicine. In this field, preventative medicine is geared towards providing treatments after the fact rather than reacting to illness. Preventative medicine aims to predict where and when illness will occur and put solutions in place before it even happens. This can include predicting where outbreaks of contagious diseases will occur, hospital readmission rates, and where lifestyle factors like diet, exercise, and environment are likely to lead to health issues in different populations or geographical areas (ex: predicting opioid addiction in communities or which patients who self-harm are most likely to attempt suicide) (Marr, 2022). Artificial intelligence makes it possible to create tools that traditional analytics processes, leading to more accurate predictions and ultimately better patient outcomes (Marr, 2022).

According to an article by Philips, one of the most pressing sources of stress and burnout in healthcare is that highly capable professionals spend an undue amount of time on routine tasks that pull their attention away from patients. A great example of this would be in the radiology departments, imaging staff state that almost 25% of the work is inefficient and could be automated (Philips, 2022). With the rise of AI in healthcare, there is not a tool that can automate tasks such as relieving the burden on imaging technologists and free up

focus for patient care (Philips, 2022). Especially in complex imaging modalities like CT and MR, AI-enabled technology can make it easier for technologists to plan and execute routine exams, helping them to get images first-time-right with enhanced confidence and precision (Philips, 2022). There will be an increased use of AI-based automation in image-guided therapy where physicians will be able to perform minimally invasive procedures on patients with heart disease or other conditions. Currently, physicians can spend up to two hours reporting on cases after a full day of treating patients. AI would be able to help alleviate this workload by auto-logging different steps of the procedure, enabling the physicians to give their full attention to proving patient care (Philips, 2022).

KMS Healthcare wrote an article about the technology solutions for healthcare to watch this year. KMS staff explain that healthcare artificial intelligence technology can understand and interpret huge waves of incoming health data at a scale and speed far beyond that of our brains (KMS Staff, 2022). Machine learning is just a version of AI that lets software and devices learn from experience to do continuously smarter and more productive things. Care coordination, revenue cycle workflows, scheduling, and every care process will get more effective and precise daily without additional human software programming (KMS Staff, 2022).
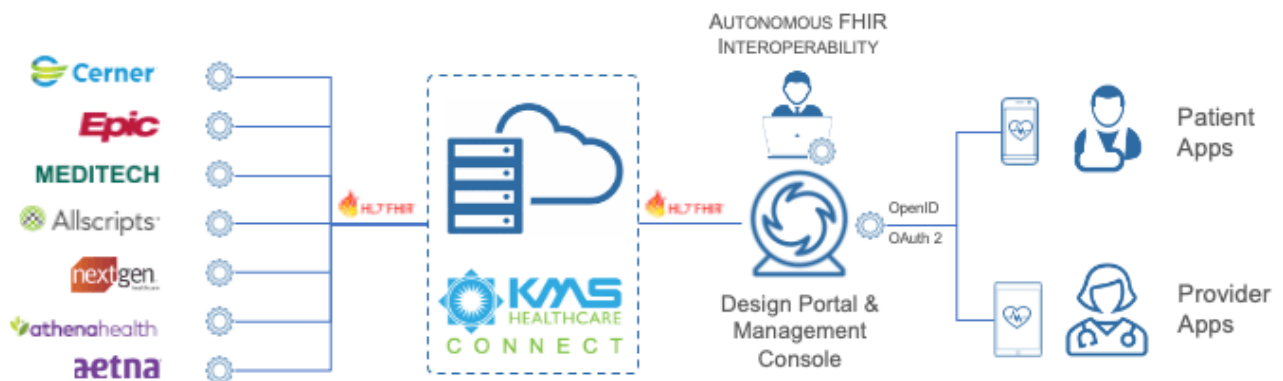
Fast Healthcare Interoperability Resources (FHIR) has been thought to fuel the future of healthcare interoperability. FHIR allows systems to share unstructured data like images, notes, and PDFs. It also embraces more modern web-based API technologies that developers prefer like RESTful protocol, JSON, XML, and RDF. FHIR also introduced "resources," which is common healthcare concepts like patients, lab results, insurance claims, and appointments, to simplify API development (KMS Staff, 2022). Epic, Cerner, Apple, and other health technology leaders have incorporated the FHIR standard. The 21st Century Cures Act and ONC have also adopted FHIR which makes this a future standard for healthcare data sharing (KMS Staff, 2022).

Burke states that AI is proving to be very valuable when it comes to detecting diseased early and for confirming an accurate diagnosis quicker. An example of this is in breast cancer care, the use of AI is enabling the review of mammograms to be 30 times faster with 99% accuracy, reducing the need for unnecessary biopsies (Burke, 2022). AI is also being used to oversee early-stage heart disease, allowing healthcare providers to discover potentially life-threatening problems at earlier and at more treatable stages. AI is also assisting clinicians to create more comprehensive treatment programs, allowing patients to manage their conditions more effectively (Burke, 2022). Drug research and discovery is one of the most recent applications for AI in life sciences. AI is able to streamline the drug discovery processes, by creating more efficient ways to discover and repurpose medicines, significantly cutting down the time it takes to market a new drug and reduce their associated costs (Burke, 2022).

3.2.3.4 Digital Twins/Simulations

Bernard Marr explains in an article what digital twins is and how this will be used in practice. Digital twins are a digital copy of an actual physical product, process, or ecosystem that can be used to run virtual simulations, using data to update and change the digital copy to reflect any changes in the real world (Marr, 2021). The idea behind digital twins is to let us see what might happen if we were to make certain adjustment in real life. These adjustments can be trialed on the digital twin without having to test potentially expensive changes on the real-world counterpart (Marr, 2021).

Digital twins were pioneered from NASA when working with digital models of real-world systems during its Apollo missions. Being able to create accurate simulations, based on real-world data, played a huge role in helping NASA bring its astronauts safely back to Earth following equipment failure on Apollo 13 (Marr, 2021). In industry 4.0, digital twins are part of a perfect storm of technology, encompassing the Internet of Things, robotics, AI, and automation. Digital twins are set to expand beyond the manufacturing sector. The research and analysts from MarketsAndMarkets indicate that the digital twin market is expected to grow from $3.8 billion from 2019 to $35.8 billion by 2025, with some of the adopters being healthcare and defence (Marr, 2021).

Digital twins are currently being used in many ways. In the energy sector, GE is using this technology to create what they call at Digital Wind Farm. This is a cloud-based model of a wind farm. This means that engineers can mix and match different turbine configurations according to the conditions on the wind farm. Once the wind turbine is installed, the digital twin model can collect and analyze from the real-life version and suggest

ways to make it even more efficient (Marr, 2021). Digital twin technology is also helping city planners understand and improve factors like energy consumption (Marr, 2021).

Healthcare is another and big area where digital twin technology is being used. It is possible to create a "digital patient" – a digital model of a human body that represents various measurements of the body, providing a personalized model of a patient over their lifetime. This is the ultimate vision of health technology company Philips. The great of idea of a complete digital patient is still being worked on but currently digital twin technology has already applied to one particular part of the body and showing great promise (Marr, 2021). Philips has created a clinical application called HeartModel, which creates a personalized 3D view of a patient's heart based on 2D ultrasound images (Marr, 2021).

The idea of this "virtual/digital patient" is digital simulations of people that are used to test drugs and treatments, with the aim of reducing the time it takes to get new medicines from the design stage into general use. In the beginning we will see these on models or simulations of individual organs or systems. But there is progress being made to work towards models in order to simulate entire bodies (Marr, 2022). Digital twins of human organs are a closer project and will allow doctors to explore different pathologies and experiment with treatments without having to harm individual patients while reducing the need for expensive human or animal trials. Back in 2014, there was a project called Living Heart Project which aimed to leverage crowdsourcing to create an open-source digital twin of the human heart (Marr, 2022). The Neurotwin project, a European Union Pathfinder project models the interaction of electrical fields in the brain, which is hoped to lead to new treatments for Alzheimer's disease (Marr, 2021).

3.2.3.5 3D Printing

3D printers are becoming a great technology in the market and especially in healthcare. 3D printed prosthetics are becoming more and more popular due to its digital functionalities allowing them to match an individual's measurements down to the millimeter. Using 3D printing for presurgical planning is a huge gain. By using a realistic replica of an actual patient's anatomy allows surgeons to attempt procedures they wouldn't have previously been able to do. This ability to plan a complex surgery and train prior to the procedure itself by using 3D-printed models will increase success rates and at the same time reduce time in the operating room and recovery time (Burke, 2022).

The use of these types of printers creates both a long lasting and soluble items. Some examples of this that Burke states in her article is 3D printing can be used to 'print' pills that contain multiple drugs, which will help patients with organization, timing, and monitoring of multiple medications. Another new medical technology in the printing field is called bio-printing. Bio-printing was originally used to be able to regenerate skin cells for skin draughts for burn victims but has slowly become much more. Scientists have been able to create blood vessels, synthetics ovaries and the pancreas using bio-printing. The ability to be able to supply artificial organs that are not rejected by the body's immune system could be ground-breaking, saving millions of patients that depend on lifesaving transplants every year (Burke, 2022).

In an article called Technology Predictions 2022: 3D printing in healthcare, the author Saracco explains that a hip ball and socket implant can be made by 3D printing to fit one particular patient. A different one will require different size and shape to replicate the original

hip ball and socket. Being able to use 3D scanning (of various types) a digital model of the hip ball and socket can be created to be an exact replica of the patient part. Below is an example of a 3D-printed titanium hip ball and socket (Saracco, 2022):

The benefits of this makes easier implantation surgeries – no need to adapt surrounding tissue and faster recovery where the patient's body doesn't need to learn how to live with a part that differs from the natural one (Saracco, 2022).

3D printing in healthcare will also incorporate organs using artificial scaffold and cultivated cells taken from the patient or sterilized cells from a donor. It has been seen that skin grafts have moved from research to clinical use where the patient's skin cells are cultivated in vitro and then used as an ink by a 3D printer to create a skin patch of the exact shape and size to use as a graft. There are other more complex organs like the bladder, liver, pancreas and yes, even the heart that are in research now but will be able to use them in clinics in the future. This type of technology will be able to transform organ transplants and be able to contribute to increasing the life span in patients in years to come (Saracco, 2022).

Healthcare impacts every single living thing on the planet and so it must be continuously evolving to keep pace with the new-age problems and issues. Today, 3D

printing technology is changing how healthcare is delivered (Stone, 2022). 3D printing has been used and seen in various industries like: healthcare, automotive, aviation/aerospace, maritime, oil & gas, energy, fashion, sports and many others. The impact has been seen in how products are manufactured, how to influence sustainable manufacturing, offer better quality, design and comfort with improved efficiency (Stone, 2022). The big impact has been seen in the healthcare sector from implants to bioprinting and from medicines to research. These applications are noticeable and revolutionary. 2021 is when we saw 3D printing jumping into the healthcare industry (Stone, 2022).

Medical implants are one of the most popular applicants of 3D printing. Usually, medical implants are artificial substitutes of damaged body parts implanted into the body as a temporary or permanent solution. With the introduction of 3D printing, the process has become even more reliable and quickly becoming the go-to process that surgeons across the world are now resorting to (Stone, 2022). According to the Facts & Factors market research, the global 3D printed implants market is expected to grow to $3.8 billion in 2026 at a compound annual growth rate of 14.3% (Stone, 2022). The medical team needs to keep in mind that 3D printing medical implants have to be unique to each patient meaning that each implant is a case-by-case scenario and there is no one size fits all (Stone, 2022).

3D printed implants using EBM technology (Goguelin, 2022).

3D printed dental implants are traditionally created using plaster where the patient is made to imprint his dental impressions which are then converted into a plaster model. This has been an effective method for a long time but tedious to both the patient and doctor. 3D printing has a simple intraoral scanner that can convert the internal scan into a 3D model. The model will then be used to 3D print the entire dental structure of the patient. This model then serves as a base for the designers to design an accurate and personalized dental implant for the patient. This method is amazing because it is accurate, done quickly, at a cheaper cost, no mess (like it does with the plaster) and has long-term results (Stone, 2022).

Zirconia is used to restore lost teeth or tooth substance by means of tooth supported crowns, fixed dental prostheses and defect-oriented restorations. (Potestio, 2019).

These are 3D printed ceramic dental implants (Boissonneault, 2022).

With the growth of 3D printing, researchers, scientists, doctors, governments, and private organizations are now focusing their efforts to build 3D printers that can print drugs according to the patient (Stone, 2022). Personalized medication will mean that each drug is tailored to each individual patient. According to Stone, the first concept was brough up in 2015 by Aprecia Pharmaceuticals and they released a pill named 'Spritam' that was FDA approved. Spritam was a pill that was designed to treat epilepsy and was manufactured using powder bed fusion technology – this was officially the first ever 3D printed drug (Stone, 2022). Below is an image of this drug printed:

This product image provided by Aprecia Pharmaceuticals shows Spritam 750 mg, foreground, and 1,000 mg tablets.

There are many companies now trying to incorporate 3D printed drugs. 3D printed drugs are manufactured using popular 3D printing technologies like Fused Deposition Modeling (FDM), Stereolithography (SLA), Direct Powder Extrusion, Selective Laser Sintering (SLS), and Injket printing (Stone, 2022). These 3D printed drugs and bills are making a huge impact in the healthcare and has secured a solid place in the future. These drugs/pills will depend on the regulatory authorities to ensure that the drugs are

standardized, its distribution is controlled by setting up processes to safeguard against black marketing or this technology leading to extreme biological warfare scenarios (Stone, 2022).

3D printed medical devices are an extremely resource-intensive time-taking and difficult process due to the unavailability of proper tools (Stone, 2022). The biggest challenge is its costly product development cycle. 3D printed medical devices bring volume flexibility, customizability, rapid iterative power, and reduction in the overall product development costs (Stone, 2022). These 3D printed medical devices can develop high-quality products with biocompatible and sterilizable materials like titanium and PEEK. PEEK in the 3D industry is a polymer of the top-notch material. PEEK is also known as polyether ether ketone. This product is colorless, organic thermoplastic polymer that achieves some of the best results out of all thermoplastics worldwide (Tractus 3D, 2021). Below is a picture of a PEEK filament:

There has been a major shortage of organs and since 2013, the total number of patients requiring a transplant has doubled while the number of available donor organs has remained the same (Morgan, 2022). According to the Health Resources & Services

Administration, every day 17 people die waiting for an organ transplant in the United States. This is now considered a public health crisis (Morgan, 2022). In 2014, there is a company called Organovo that is based in California, had successfully engineered a commercially available 3D-bioprinted human livers and kidneys. The process of 3D printing begins with obtaining a sample of the patient's own cells to grow and expand outside the body in a sterile incubator or bioreactor. The cells are then fed with nutrients called 'media' and mixed with a gel that acts as a glue. This mixture is then loaded into the printing chamber to build the tissues by building the material up layer by layer (Morgan, 2022). The biggest challenge we face now is to get the organs to function as they should. There are a lot of progress being made in this field however, Dr. Anthony Atala and his colleagues at the Wake Forest Institute for Regenerative Medicine are conservative with their estimate about the number of years remaining before fully functioning 3D-printed organs can be implanted into humans (Morgan, 2022).
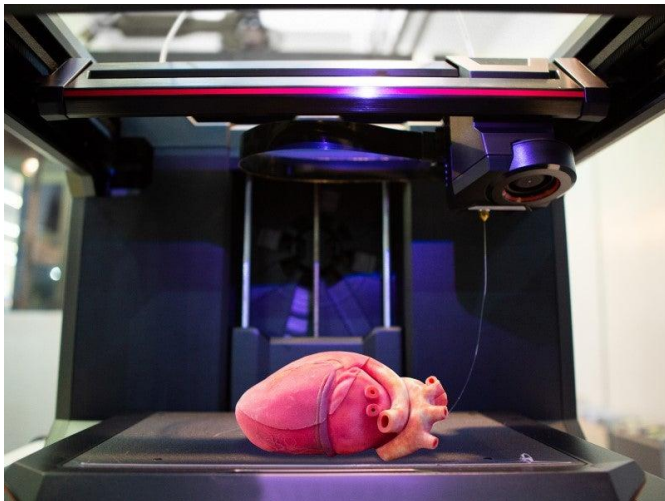
Due to advancements in technology, 3D-printed organs have become a reality. Credit: Scharfsinn / Shutterstock.

3D printed organs are one of the frontiers of 3D printing in healthcare. However, 3D printing of organs is currently not possible. Not only is this about 3D printing an organ but also to check its operability, stability, sustainability, reliability, and durability over years of functioning (Stone, 2022). There are many research organizations and institutions that are currently focusing on the developing practical solutions and many are being fully funded. The end goal here is to have a functional 3D printed organ but nobody knows a timeline when this will be completed (Stone, 2022). Stone has stated in his article that just last year, and Israeli researcher 3D printed a miniature heart model. This model was a first of its kind made from human tissue. This is a huge step towards a breakthrough of building a 3D printed organ that is compatible with individual patients. But the idea itself of replacing organs in the future will change healthcare drastically and hopefully we will see this soon (Stone, 2022).

CHAPTER FOUR

FINDINGS AND RESULTS

4.1 Introduction

The aim of this research paper is to be able to find the best practice models for clinical flow for practical labor purpose in clinics and hospitals. In this paper I have discussed three best practices and ways to use these practices efficiently. These practices include: improving patient flow that will impact efficiency, strategies for healthcare improvement to drive better care at lower costs, and the use of technology to reduce healthcare inequities.

A best practice is more than practice based on evidence. This really represents the quality care which is believed optimal. Best practices in general are health practices, methods, interventions, procedures or techniques based on high-quality evidence in order to obtain improved patient and health outcomes. When considering best practices, evince by itself is not sufficient enough to ensure evidence-based decision making but does require and uptake and sustained implementation of the evidence itself (Ham-Baloyi, Minnie, van der Walt, 2020).

Best practices comprise recent, relevant, and helpful nursing/doctors/management, etc. practices, methods, interventions, procedures or techniques based on high-quality evidence. In general, best practices should be applied in order to improve individual patients' health outcomes as well as the overall quality of health care and to be able to strengthen the health system at large (Ham-Baloyi, Minnie, van der Walt, 2020). This research paper has gone into detail on each of the three best practices listed above. The overall research paper is outlined with five distinctive chapters. These chapters consist of:

the introduction, literature review, methodology, findings and results and lastly summary, conclusions and recommendations.

4.2 Data of Findings

4.2.1 Definitions and understanding of best practices

In the next few sections I will be discussing and explaining in further details why these best practices are ideal for a hospital or clinical settings. I will also explain the subsections I had discussed in the last chapter.

4.2.1.1 Best Practice 1

Best practice one is to improve patient flow that will impact efficiency. Enrique and Marta Burches, both MD's, state in an article that many scientific fields where there has been imposed an artificial interpretation of the term's efficacy, effectiveness, and efficiency. Efficacy in defined in the health care sector as the capacity of a given intervention under ideal or controlled conditions. Effectiveness is the ability of an intervention to have a meaningful effect on patients in normal clinical conditions. And efficiency in the healthcare field is doing things in the most economical way (Burches & Burches, 2020). These authors state that it would be more correct to define as strategic efficacy/effectiveness to the aptitude to produce an effect realized in ideal conditions and tactical efficacy/effectiveness to the same effect looked in ordinary circumstances (Burches & Burches, 2020).

4.2.1.1.1 Tip 1

In the previous chapter I had explained the top ten tips used for improving patient flow that will impact efficiency. In these next few paragraphs, I will go through briefly with those same tips and define and discuss them more. The first tip states that everyone should share capacity data and ensure the patients arrive or can be transferred to places with sufficient capacity to take care of them. Storage capacity refers to the specific amount of data storage that a device or system can accommodate (Techopedia, 2016).

On the other hand, capacity describes a person's ability to make a decision. In a medical context, capacity refers to the ability to utilize information about an illness and proposed treatment options to make a choice that is congruent with one's values and preferences. Capacity is defined around a specific medical decision; individuals may have capacity in one clinical context but not in another and vice versa (Karlawish, 2021). Jason Karlawish, MD further explains in an article that he main determinant of capacity is cognition, and any condition or treatment that affects cognition may potentially impair decision-making capacity (Karlawish, 2021).

Jason Karlawish further explains that in the presence of cognitive impairment from any cause, determining whether a patient has adequate capacity is critical to striking the proper balance between respecting patient autonomy and acting in a patient's best interest. A skillful capacity assessment can also help determine the severity of a patient's cognitive impairments and improve the effectiveness of conversations with patients and their families. He further explains that these skills are especially important in the care of adult patients who have diseases that impair cognition. Patients with traumatic brain injury (TBI), psychiatric

illnesses (eg, schizophrenia, bipolar disorder, and unipolar major depression), and neurodegenerative diseases (eg, Alzheimer disease [AD] and Parkinson disease [PD]) are at risk for impaired capacity. Hospitalized patients and older adults are also at risk due to cognitive impairment from chronic diseases, cognitive aging, and delirium (Karlawish, 2021).

4.2.1.1.2 Tip 2

Tip two was defined as those in the medical field should coordinate the arrival and discharge of patients undergoing elective procedures. Care coordination involves deliberately organizing patient care activities and sharing information among all of the participants concerned with a patient's care to achieve safer and more effective care. This means that the patient's needs and preferences are known ahead of time and communicated at the right time to the right people, and that this information is used to provide safe, appropriate, and effective care to the patient (Agency for Healthcare Research and Quality, 2018). The main goal of care coordination is to meet patients' needs and preferences in the delivery of high-quality, high-value health care. This means that the patient's needs and preferences are known and communicated at the right time to the right people, and that this information is used to guide the delivery of safe, appropriate, and effective care (Agency for Healthcare Research and Quality, 2018).

During COVID-19 pandemic, most if not all health care systems across the country put procedures known as "elective surgeries" on hold. Now, the pandemic has lifted and all types of procedures are back. Elective surgeries are important procedures that can be scheduled in advance. Urgent or emergency surgeries are where the patient needs

immediate, possibly life-threatening issues that need medical attention right away. Elective surgeries can include many types such as: cosmetic procedures like removing a mole or a wart. Some are more serious like hernias or removing a kidney stone or even an appendix and sometimes a hip replacement. Others include: ear tube surgery, tonsillectomies, bariatric (weight loss) surgery, eye surgery (ex: cataracts or strabismus), spinal fusion surgery for scoliosis, various surgery for sports injuries, etc. (Rusciano, 2020).

Elective surgeries are vital to a patient's health and well-being. Another example of an elective surgery can be breast cancer surgery like a mastectomy, which is critical to address but does not qualify for an emergency procedure needing to be done the same day. Elective surgeries allow doctors the opportunity to work with patients to improve their overall health. Dr. Sanz, a surgeon at OSF HealthCare Saint Anthony's Health Center in Alton, Illinois states that, "One of the benefits of elective surgeries is the days or weeks patients use to improve their health before their procedure. I tell patients that a surgery can be a physically demanding experience, so the best time for patients to improve their overall health is before an elective procedure. We know increased smoking and having diabetes can stop healing and could lead to wound complications after an elective surgery. So, reducing these risk factors gives patients the best chance of a successful elective surgery with long-term health improvements. I recommend to patients before an elective surgery to reduce bad habits like smoking, lose weight, exercise more, and eat healthier foods" (Rusciano, 2020).

4.2.1.1.3 Tip 3

Tip three was described as establishing timely discharge in the morning hours. Timely discharge of stable patients is one way to improve bed turnover and is a skill that

should be mastered by all doctors (Dainty & Elizabeth, 2009). Dainty and Elizabeth further state that discharging patients can be straightforward although there are often obstacles to address especially for the older patients with multiple pathologies and disabilities who may have complex needs (Dainty & Elizabeth, 2009). Generally, hospitals discharge patients between 11am and 1pm. The physicians can discharge earlier or later pending required information and proper medical clearance.

In an article by the Institute for healthcare improvement, they discuss improving flow when discharging patients. These authors state that discharges are not managed efficiently when they are unable to synchronize admissions and discharges. Creating a more consistent and predictable discharge schedule can help improve flow (Institute for Healthcare Improvement, 2022). This article states that traditionally, hospitals have attempted to "batch" discharges by establishing a set time for all patients to be discharged, but this kind of approach has been unsuccessful.

Scheduling the discharge creates a continuous flow process, spreading discharge times throughout the day. This approach streamlines the process, better addresses the needs of patients and families, and helps coordinate the placement of patients who are admitted and transferred with discharges that occur throughout the day (Institute for Healthcare Improvement, 2022). Provide a process for scheduling the date and time that patients will be discharged one day in advance or on the day of discharge. In some units, like surgical units, the discharge can be planned a day ahead of time. Sometimes for some patients the date and time of discharge cannot be planned a day in advance, but the hospital should still be able to coordinate the discharge. In most cases, orchestration of the

discharge is left to chance, creating a chaotic situation. Having a planned discharge time helps everyone involved orchestrate their activities toward a common goal (Institute for Healthcare Improvement, 2022).

4.2.1.1.4 Tip 4

Tip four is explained by improving hospital layout for easy navigation. Going to a hospital to visit someone or for yourself can be intimidating. Hospitals or even clinics can be large and confusing and have multiple departments that move, expand, and renovations occur which makes it even more difficult to figure out how to get around a healthcare space. These healthcare spaces have mapping and various types of navigation tools to help patients, visitors, even healthcare workers.

Lucy Braggs is an author of the article Indoor Navigation in Hospitals: Improving the Patient Experience. She sates that when patients and visitors arrive at a hospital they are usually in a high-stress state and need help to locate their destination immediately. Unfortunately, there is an absence of unique features that guide their arrival, and many wayfinding tools that exist today are unsatisfactory. Braggs further explains that static maps and signs are often confusing and unsuccessful at leading visitors to their destination, and while staff and volunteers can show visitors around, this takes valuable time from the hospital staff (Bragg, 2021).

A solution to navigating hospitals is called digital indoor mapping. Braggs explains that the digital indoor mapping and navigation makes discovering a location easier and less time-consuming.   Indoor navigation technology calculates the fastest route to your

destination, providing accurate turn-by-turn directions and wayfinding. This improves the overall patient and visitor experience at hospitals, and helps property managers keep their maps updated and accurate as facilities change and grow. Here are a few ways that this technology can be implemented in hospitals (Bragg, 2021):

- Website

- Mobile application

- Kiosks and directories

- Printed materials

- QR codes

On a hospital's website, this technology allows patients to search and locate a department, the registration desk, and more, prior to their visit. One of the benefits of using this technology is that you only need a small amount of information, such as your doctor's name or the name of the procedure, in order to be routed to the proper registration desk or waiting area. With a wayfinding application, indoor maps and navigation can be accessed directly through a patient's mobile device. This way, you can take directions on-the-go, and avoid having to wonder "where do I go now?". Not only does this provide a seamless experience for visitors and patients, but it makes indoor maps accessible from any device (Bragg, 2021).

These indoor maps can also be implemented within directories where visitors and patients can self-serve and free up valuable time taken away from healthcare providers and volunteers. Another great idea is to place kiosks and directories at main points of entry and

around the hospital to aid patients in their start-to-end journey. This is important as hospitals have miles of halls and corridors that are almost identical, making it easier to get lost throughout your journey. With directories around common points of interest, this problem can be avoided (Bragg, 2021).

Printed materials are another great resource and can be used to offer indoor navigation capabilities across the hospital. QR codes can be added on printed materials and signage throughout the hospital that, when scanned, will pull up an interactive map in the browser of one's mobile phone. This can also be used to pre-populate directions directly to a location, such as the eye department featured on a printed brochure. QR codes can also be placed on appointment cards so that patients can quickly look up directions before their next appointment (Bragg, 2021).

Bragg explains that the unique thing about QR codes is that they can also be implemented on kiosks and directories to offer a touchless experience. On a contactless kiosk, patients and visitors can scan QR codes and utilize the kiosks' offerings from their mobile device. This, in turn, will allow users to avoid contact with the touchscreen, thereby helping with the spread of germs. This not only presents a health and safety measure, but it also offers convenience to patients, visitors, and staff (Bragg, 2021).
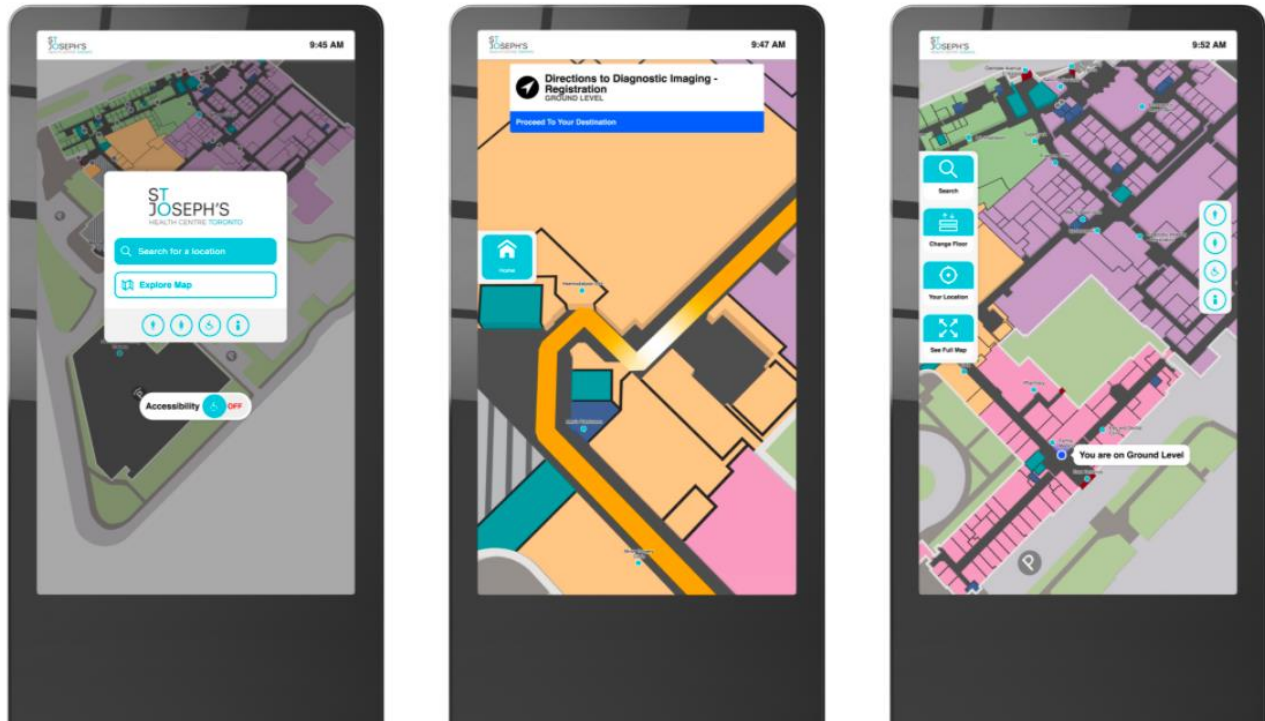
Here is a picture of an example of the indoor mapping and navigation from Lucy Bragg (Bragg, 2021).

4.2.1.1.5 Tip 5

Tip five states to form a patient flow team for quality improvement. Patient flow is defined as the movement of patients through a healthcare facility. It involves the medical care, physical resources, and internal systems needed to get patients from the point of admission to the point of discharge while maintain quality and patient/provider satisfaction. Improving patient flow is a critical component of process management in hospitals and other healthcare facilities (NEJM Catalyst, 2018).

Quality improvement is defined as the framework used to systematically improve care. Quality improvement seeks to standardize processes and structure to reduce variation, achieve predictable results, and improve outcomes for patients, healthcare systems, and organizations. Structure includes things like technology, culture, leadership, and physical capital; while process includes knowledge of capital (ex: standard operating procedures) or human capital (ex: education and training) (Centers for Medicare & Medicaid Services, 2021).

According to the Agency for Healthcare Research and Quality, there are multiple research studies that have shown the importance of creating multidisciplinary teams to plan quality improvement interventions. One of the benefits of a multidisciplinary team is that members will bring diverse viewpoints and knowledge about problems, their underlying causes, and potential solutions. These team members may also be able to offer different resources and encourage buy-in for the solutions among their peers. For these reasons, identifying the right individuals to participate in executing the patient flow improvement strategies will be essential to the success of your effort. Once formed, the team should meet on a regular basis (e.g., weekly) throughout the planning and implementation stages (Agency For Healthcare Research and Quality, 2018).

4.2.1.1.6 Tip 6

Tip six is stated as the team should gain executive support and direction for improving patient flow. In many companies and in particular in various projects, the lack of executive support has been proven to inhibit companies and the reason why most projects fail. One

of the main and most common executives is the CEO. A CEO is defined as the chief executive officer and is the highest-ranking executive in a company (Hayes, 2022). A CEO's primary responsibilities include making major corporate decisions, managing the overall operations and resources of a company, acting as the main point of communication between the board of directors and corporate operations. The CEO is mainly serves as the public face of the company.

CEOs are often responsible for expanding the company, driving profitability, and in the case of public companies, and improving share prices. CEOs manage the overall operations of a company. There was a study that shows that 45% of the companies' performance is influenced by the CEO, while others show that they affect 15% of the variance in profitability (Hayes, 2022). An article by Adam Hayes further explains the roles of CEOs in a company. Hayes states that the CEO's roles do vary from one company to another depending on the company's size, culture, and corporate structure. In the larger corporations, CEOs usually only deal with the very high-level strategic decisions and those that direct the company's overall growth.   Hayes gives an example of CEOs working on strategy, organization, and culture. Specifically, they may look at how capital is assigned across the firm, or how to build teams to succeed (Hayes, 2022).

From an article I had stated in a previous paragraph, 5 ways CEOs can actually change hospital culture, she goes over the five ways CEOs can do this. Katie Sullivan is the author of the article on how CEOs can change hospital culture. She states that hospital CEOs should focus less on talking about an organization's culture and more on the elements

that make up a hospital's culture like mindset, methods, strategies, and structures (Sullivan, 2014).

Within Sullivans article, a former physician John Kenagy, founder of Kenagy & Associates, states that there are five successful actions of adaptive leaders, who can best align rapid front-line decision-making within employees' ranks. The first is setting a clear direction. Voice a clear vision of ideal patient care – lower costs, increase in care quality and better population health – this will make the employees respond and improve when care isn't ideal (Sullivan, 2014). The second is to treat people as your best resource. "It's the organization's ability to increase the adaptive capacity of the people and aligning those behaviors to a common purpose that leads to success" stated Kenagy (Sullivan, 2014).

The third successful action is building trust. Celebrate employee ideas that result in better care and treat failures as learning opportunities. This will make employees feel safe and open to vocalize ideas and concerns (Sullivan, 2014). The fourth is problem-solve flawed processes. Challenge the employees to change and employ processes that will propel the hospital toward ideal patient care (Sullivan, 2014). And the fifth and last is to grow relentlessly. Kenagy quoted, "good managers marshal their forces when the organization stalls. Great managers opportunistically and relentlessly challenge the status quo" (Sullivan, 2014).

4.2.1.1.7 Tip 7

Tip seven is stated to explore different staffing models. A staffing model (this can also be called a staffing plan) is defined as a group of reports, charts, graphs, and other data

that measure and describe your business's work activity, labor needs, and expenditures both

time and money associated with the way your team operates (Sling Team, 2022). A staffing

model is a predictive tool that makes it easier for your HR department to identify annual

business needs and formulate to plan to meet those requirements. A good staffing model

reveals various skills and knowledge your employees will need in order to reach the goals

you've set both personally and for the business as a whole (Sling Team, 2022).

4.2.1.1.8 Tip 8

Tip eight is to set goals with attention to patient acuity. Patient acuity is generally

defined as a measurement of intensity of nursing care needed by a patient. Proper

development of a staffing plan for people receiving hospital care, patient acuity is a

particularly critical benchmark (Patient Safe Staffing, 2020). Hospitals measure and set

goals for patient flow based on the availability of patient beds, the throughput of areas where

patients receive care treatment, and services like inpatient units, laboratory, and radiology.

Other goals are the safety of areas where patients receive care, treatment, and services as

well as the efficiency of the non-clinical services that support patient care and treatment like

housekeeping and transportation and access to support services like case management and

social work (Richards, 2021).

4.2.1.1.9 Tip 9

Tip nine is using highly-trained staff on time management. Time management is defined as the process of planning and exercising conscious control of time spent on specific activities, especially to increase effectiveness, efficiency, and productivity (Wikipedia Foundation, 2022). Time management involves various demands on a person relating to work, social life, family, hobbies, personal interests, and commitments with the finite nature of time. Time management may be aided by a range of skills, tools, and techniques used to manage time when accomplishing specific tasks, projects, and goals complying with a due date (Wikipedia Foundation, 2022).

4.2.1.1.10 Tip 10

Tip ten is to utilize advanced data analytics. Advanced analytics is defined as the autonomous or semi-autonomous examination of data or content using sophisticated techniques and tools, typically beyond those of traditional business intelligence (BI), to discover deeper insights, make predictions, or generate recommendations (Gartner, 2022). Advanced analytic techniques include those such as data/text mining, machine learning, pattern matching, forecasting, visualization, semantic analysis, sentiment analysis, network and cluster analysis, multivariate statistics, graph analysis, simulation, complex event processing, and neural networks (Gartner, 2022).

Advanced analytics will provide better coordination of care, customer service and operations. Data analytics is the process of examining raw datasets to find trends, draw conclusions and identify the potential for improvement. Health care analytics uses current

and historical data to gain insights, macro and micro, and support decision-making at both the patient and business level (Health Informatics, 2021). The use of health data analytics allows for improvements to patient care, faster and more accurate diagnoses, preventative measures, and more personalized treatment and more informed decision-making (Health Informatics, 2021). When we look at the business level of health data analytics, it can lower costs, simplify internal operations and more.

On the business side, there is data being collected on the processes and procedures and a massive amount of health data being gathered, stored and analyzed. Health data is any data relating to the health of an individual patient or collective population (Health Informatics, 2021). This type of data is gathered from a series of health information systems (HIS) and other technological tools utilized by health care professionals, insurance companies and government organizations. Within this data, we are able to see a holistic view of each individual patient as well as trends tied to location, socioeconomic status, race and predisposition (Health Informatics, 2021).

This information can then be collected and broken down into various datasets that are analyzed by a variety of tools and systems to collect, store, share and analyze health data gathered through various means. These tools include:

- Electronic Health Records (EHRs)

- Personal Health Records (PHRs)

- Electronic Prescription Services (E-prescribing)

- Patient Portals

- Master Patient Indexes (MPI)

- Health-Related Smart Phone Apps and more

Must-Have and Possible Features of EHR System

Must-Have

- Remote access
- Notes with navigation
- Scheduling
- E-prescribing
- Access to patient records
- Customizable EHR workflows
- Documentation shortcuts
- Auto-link for documents

Possible

- Mobile accessibility
- Patient portals
- Patient record management
- Lab analytics
- Payment management
- Reminders

(Emerline team, 2021).

Must-Have Features of PHR

High security standards

Confidential data locking

Scanner and uploader for records

Reminders

Integrations (e.g.: mobile SMS)

(Emerline Team, 2021).
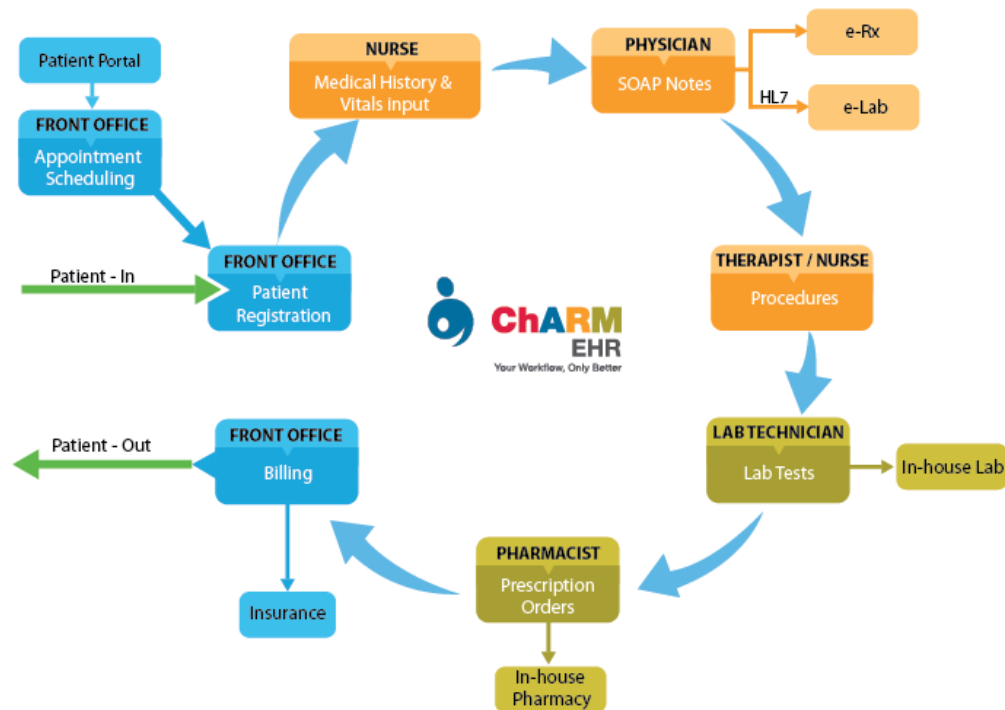
(Medical Mine Inc., 2022).

With digital data collection, there is a lot of health care data to be analyzed every second. There is an increase of electronic record keeping, applications and other electronic means of data collection and storage and there is a significant amount of data being collected in real time (Health Informatics, 2021). These data sets are so complex that traditional processing software and storage options cannot be used. Cloud storage is a necessity when dealing with "Big Data". Cloud storage is built to be secure, an absolute must when dealing with sensitive patient information. This is also very cost-efficient and has been helpful in lowering the increasing cost of health care (Health Informatics, 2021).

There are three types of big data analytics we use to help answer questions being asked in the health care settings. These are: descriptive, predictive and prescriptive. Descriptive analytics uses historical data to draw comparisons or discover patterns. This

type of analysis is best for answering questions about what has already occurred and we can gain insight into the past with descriptive analytics (Health Informatics, 2021). Predictive analytics uses current and historical data to make predictions about the future.

The models created with this type of analytics are best for answering questions about what could happen next and we gain insight into the future with predictive analytics (Health Informatics, 2021). Prescriptive analytics will also make predictions about future outcomes. Machine learning is a big factor with this type of analytics. The information provided can help determine the best course of action and we can gain insight on what course of action should be taken to reach the most ideal outcome with prescriptive analytics (Health Informatics, 2021).

The collection of data in health care settings has become more updated in recent years. Data helps improve day-to-day operations and helps provide better patient care, as it can now be used in predictive modeling. Now we are able to use both datasets to track trends and make predictions instead of looking at historical/current information. We can now take preventive measures and track the outcomes (Health Informatics, 2021).

More recently, there has been a growing demand for patient-centric, value-based, medical care which has led to predictive and preventive measures in regards to public health. With the use of data, instead of treating symptoms as they present, practitioners are able to identify patients at high risk of developing chronic illnesses and help to treat an issue before it surfaces. This will help lower costs for the practitioner, insurance company and patient as the preventive treatment may help to stay off long-term issues and expensive hospitalizations (Health Informatics, 2021). If hospitalization is required, data analytics helps

practitioners predict risks of infection, deterioration and readmission. This will also help lower costs and improve patient care outcomes (Health Informatics, 2021).

4.2.1.2 Best Practice 2

Best practice two are strategies for healthcare process improvement that drive better care at lower costs. When healthcare leaders set goals for their organizations like preventing patient falls or a medical system aims to lower opioid use after surgery, they call this process quality improvement (Gagnon, 2022). Debra Sowell, a DNP from clinical faculty in Southern New Hampshire University quoted, "Quality improvement is the systematic approach that is guided by data to improve the quality and safety of healthcare delivery. Quality improvement focuses on care that is safe, timely, effective, efficient, equitable and patient-centered" (Gagnon, 2022).

Health catalyst authors state that healthcare processes drive activities and outcomes across the health system, from emergency department admissions and procedures to billing and discharge (Health Catalyst Editors, 2022). During COVID-19, there was a lot of uncertainty and due to this, there was an increase in process quality in the care delivery and organizational success. Process improvement is fundamentally linked to better outcomes and lower costs (Gagnon, 2022). In the next few paragraphs, I will go over the six strategies for healthcare process improvement and show the roles of strategy, skillsets, culture and advanced analytics in healthcare's mission of transformation.

4.2.1.2.1 Strategy 1

Strategy one is transforming the delivery of care in the emergency department. An article titled "Work Methods for Nursing Care Delivery" further defines the delivery of care in a healthcare environment. These authors state that in any healthcare institution, the goals of safe and successful care delivery include the pursuit of excellence in quality and safety at the lowest cost while improving patient and family satisfaction outcomes (Marques, Neri, Parreira, Queiros, Salgueiro-Oliveira & Santos-Costa, 2021). In order to achieve these goals and objectives, the organization has to create a care delivery model that fits its vision and mission and is able to combine the human and material resources available. Typically, nurse managers are responsible for these tasks which can also include the selection of nursing care organization methodologies and the creation of conditions for their implementation, depending on their experience in the professional practice and the decision-making processes of the healthcare institutions (Marques, Neri, Parreira, Queiros, Salgueiro-Oliveira & Santos-Costa, 2021).

An emergency department is defined as the department of a hospital responsible for the provision of medical and surgical care to patients arriving at the hospital in need of immediate care (Davis, 2021). Emergency department personnel may also respond to certain situations within the hospital such as cardiac arrests. Another word for emergency department is the emergency room or the ER. In the emergency department, there have been and even more recently from COVID-19, overcrowding. This overcrowding has been associated with the increase in inpatient mortality, length of stay, and costs for the admitted patients. The wait times in the emergency department are too long and patients end up

leaving without seeing a qualified medical provider. There was a data-driven approach that addresses these common problems with overcrowding in the emergency department and gives guidelines on redesigning the emergency care delivery (Health Catalyst Editors, 2022). These approaches include: a four-step approach to redesigning the delivery of emergency care, understanding emergency department performance, revising high-impact workflows, revising staffing patterns, setting leadership expectations, and improving the patient experience (Health Catalyst Editors, 2022).

4.2.1.2.2 Strategy 2

Strategy two is to adopt the six lean methodologies for healthcare improvement. Lean is a set of operating philosophies and methods that help create a maximum value for patients by reducing waste and waits. It emphasizes the consideration of the customer's needs, employee involvement and continuous improvement (Flynn, Harrison, Jeffery, Khan, Kinsman, Kutz, Lawal, Rotter & Sari, 2014). This lean methodology aims to essentially change organization thinking and value which will lead to the transformation of the organization behavior and culture over time (Flynn, Harrison, Jeffery, Khan, Kinsman, Kutz, Lawal, Rotter & Sari, 2014).

The application of lean management in health care can also be holistic such as the transformation of an overall business strategy (Flynn, Harrison, Jeffery, Khan, Kinsman, Kutz, Lawal, Rotter & Sari, 2014). Lean utilizes a continuous learning cycle that is driven by the 'true' experts in the processes of health care, being the patients/families, health care providers and support staff (Flynn, Harrison, Jeffery, Khan, Kinsman, Kutz, Lawal, Rotter &

Sari, 2014). The majority of lean investigations published in the international literature refer to the Toyota management system as applied to health care. An example of this is the Virginia Mason Medical Center's application of lean 'became the catalyst for lean health care' in other health systems, particularly in the United States and the Untied Kingdom (Flynn, Harrison, Jeffery, Khan, Kinsman, Kutz, Lawal, Rotter & Sari, 2014)
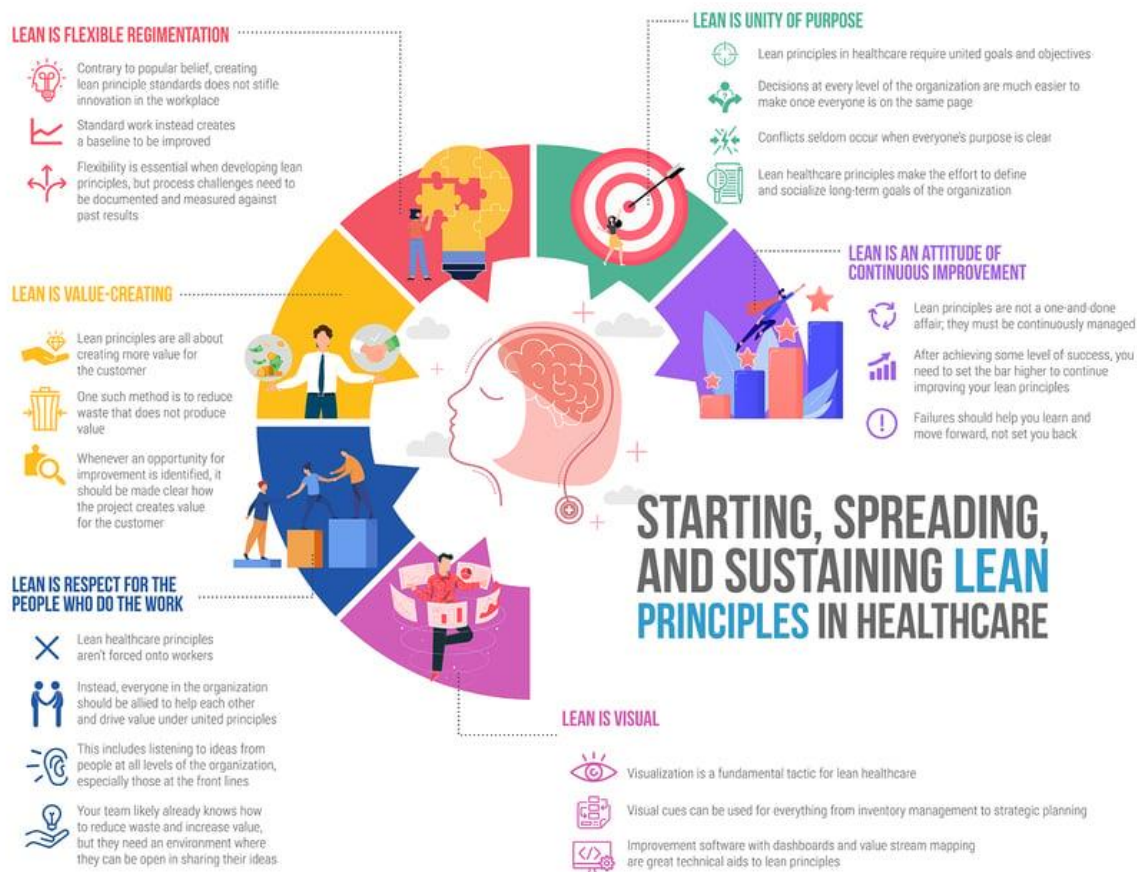
(Jacobson, 2021)

Lean is an attitude of continuous improvement. This isn't something someone can do in a day and just check it off their list. One doesn't' become healthy and then move onto something else. Managers need to manage the health of their lean organization every single

day. Once the manager is able to achieve success, that's when you are able to set the bar even higher. Lean practitioners work toward perfection, knowing that it is impossible to achieve, but worth absolutely worth the endeavor and know that failure is okay as long as you are always failing forward (Jacobson, 2021).

Lean is value-creating. Eliminating waste is a result of lean implementation because it is about creating value for the customers and waste does not produce value. Every time there is an opportunity for improvement, everyone involved should be clear on how the project is expected to create value as defined by the customer (Jacobson, 2021). Lean is the unity of purpose. When everyone has aligned goals and objectives, decision making is easier at every level of the organization (Jacobson, 2021).

Lean is respect for the people who do the work. Within lean healthcare, when it is properly executed, everyone in the organization is allied in driving value and helping every single employee do their best work (Jacobson, 2021). This essentially means listening to ideas from people on the front lines and getting every person involved in improvement. When leaders respect the wisdom of the people who do the work, they unlock an enormous amount of hidden potential (Jacobson, 2021). Lean is visual. Visualization is a fundamental to the lean approach. Visual cues can be used for everything from inventory management to strategic planning. Whatever the challenge, lean thinkers are always looking for a way to use images to convey information (Jacobson, 2021).

Lean is a flexible regimentation. One of the most challenging ideas for people to grasp about lean healthcare is that standard work is necessary for innovation (Jacobson, 2021). People fear that creating a standard and expecting everyone to stick to it will stifle

innovation and bring improvement to a halt. Standard work creates the baseline for improvement. Flexibility is essential in lean but process changes should always be deliberate, documented, and measured against past results (Jacobson, 2021).

4.2.1.2.3 Strategy 3

Strategy three is to improve hospital patient flow with machine learning. Patient flow is defined as the movement of patients through a healthcare facility. Patient flow involves the medical care, physical resources, and internal systems needed to get patients from the point of admission to the point of discharge while maintaining quality and patient/provider satisfaction (NEJM Catalyst, 2018). Patient flow is mostly associated with hospitals, especially with back-ups and overcrowding in emergency departments and inefficient scheduling in surgical departments (NEJM Catalyst, 2018).

Poorly managed patient flow in hospitals can lead to adverse health outcomes, including increased re-admissions and mortality rates. Even when we look at those hospitals that are expanding their facilities and hiring additional staff, they are not immune to issues of overcrowding and poor orchestration of patient admission, transfers, and discharges (NEJM Catalyst, 2018). Inefficient scheduling leads to some patient flow problems. This can be seen in surgical services where they schedule the majority of their elective surgeries earlier in the week so that patients can recover when resources are more available. Unfortunately, this kind of strategy causes post-operative units to become overcrowded and staff and other support services are really stretched thin (NEJM Catalyst, 2018).

Machine learning in healthcare is used to draw insights from large medical data sets to enhance clinicians' decision-making, improve patient outcomes, automate healthcare professionals' daily workflows, accelerate medical research, and enhance operational efficiency (Koptelov, 2022). Machine learning is a subset of artificial intelligence that plays a key role in many health innovations, including the development of new medical procedures, the handling of patient data and records and the treatment of chronic diseases (Thomas, 2022). Machine learning is applied in a wide range of healthcare use cases. Some of these cases include: predicting and treating disease, providing medical imaging and diagnostics, discovering and developing new drugs, and organizing medical records (Thomas, 2022).

Machine learning crunches large volumes of data to help healthcare professionals generate precise medicine solutions customized to individual characteristics. Machine learning and AI are expected to play a critical role in central nervous system clinical trials in the future. Other potential developments within the healthcare sector includes telemedicine. Some machines learning companies are researching how to organize and deliver patient information to doctors during these telemedicine sessions as well as capture information during virtual visits to streamline workflows (Thomas, 2022).

Pharmaceutical companies are also looking into machine learning. These companies want to use and expand on machine learning to help with drug discovery and drug development. They predict that machine learning will one day lead drugmakers to predict the way patients will respond to various drugs and identify which patients stand the greatest chance of benefiting from the drug (Thomas, 2022). The U.S. Food and Drug Administration

has passed a few policies that allow medical devices to use AI and machine learning technologies (Thomas, 2022).

There are many benefits of using machine learning in the healthcare field. One of them is automated routine tasks. From streamlining HER processes to virtual nursing, machine learning can help healthcare professionals to automate many routine and repeatable tasks (Koptelov, 2022). Another benefit is reduced risks. Predictive analytics allows for early detection of serious illnesses, reduced risks during robot-assisted surgeries, and quick identification of high-risk patients (Koptelov, 2022).

Improved patient outcome is another great benefit when using machine learning in the healthcare field. With well-though-out decision-making systems powered by machine learning, healthcare professionals can make more informed decisions and improve patient outcomes (Koptelov, 2022). Reduced operational cost is another great benefit. Machine learning-enabled automation of back-office tasks allows healthcare organizations to cut costs and improve resource management (Koptelov, 2022).

Enhanced patient experience – with the help of chatbots and virtual assistant, healthcare organizations can improve patient experience by streamlining access to basic healthcare services (Koptelov, 2022). Improved decision-making – by detecting patterns in enormous healthcare data sets, machine learning helps clinicians to streamline diagnostics and improve decision-making (Koptelov, 2022). Extended access to healthcare – with efficiencies unlocked by machine learning, organizations can help more patients without compromising care quality (Koptelov, 2022).

4.2.1.2.4 Strategy 4

Strategy four is to prevent medication errors. Preventing harmful medication errors is a huge improvement for the health systems. There is a potential industrywide savings of close to $21 billion and an impact on more than seven million patient lives (Health Catalyst Editors, 2022). There is approximately fifty percent of adverse drug events that are preventable, making their reduction a highly impactable area of process improvement (Health Catalyst Editors, 2022).

A medication error is defined as any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the healthcare professional, patient, or consumer (FDA, 2019). Medication errors can occur throughout the medication-use system. This happens when prescribing a drug, upon entering information into a computer system, when the drug is being prepared, or when the drug is given to or taken by a patient (FDA, 2019).

The U.S. Food and Drug Administration (FDA) receives a ton (over 100,000) of reports every single year associated with a suspected medication error (FDA, 2019). The FDA takes these reports and classifies them to determine the cause and type of error. The reports that are sent to the FDA are from various drug manufacturers and healthcare professionals as well as consumers through MedWatch, the Agency's safety information and adverse event reporting program (FDA, 2019). These serious harmful results of a medication error may include but is not limited to: death, life threatening situation, hospitalization, disability, and birth defect (FDA, 2019).

Medication errors are among the most common medical errors, harming at least 1.5 million people every year (AMCP, 2019). The extra medical costs of treating drug-related injuries occurring in hospitals alone are at least to $3.5 billion a year, and this estimate does not take into account lost wages and productivity or additional health care costs (AMCP, 2019). Medication error morbidity and mortality costs are estimated to run $77 billion dollars per year (AMCP, 2019). Patient safety is a major public health concern.

One of the largest causes of therapeutic medication misadventures is incorrectly prescribed medication. The number of patient deaths resulting from drug errors has increased from 198,000 in 1995 to 218,000 in 2000 (AMCP, 2019). The cost of these misadventures to the US economy is more than $177 billion per year (AMCP, 2019). The term dispensing error refers to medication errors linked to the pharmacy or to whatever health care professional dispenses the medication. These include errors of commission (examples include: dispensing the wrong drug, wrong dose or an incorrect entry into the computer system) and those of omission (examples include: failure to counsel the patient, screen for interactions or ambiguous language on a label) (AMCP, 2019).

The article written on the Academy of Managed Care Pharmacy also states that (AMCP, 2019): preventable errors occur because systems for safely prescribing and ordering medication are not appropriately used.

- A widely recognized cause of error is illegible handwritten prescriptions.

- Errors may result from insufficient or missing information about co-prescribed medications, past dose-response relationships, laboratory values and allergic sensitivities.

- Errors in prescribing can occur when an incorrect drug or dose is selected, or when a regimen is too complex.

- When prescriptions are transmitted orally, sound-alike names may cause error.

- Similarly, drugs with similar-looking names can be incorrectly dispensed when prescriptions are handwritten.

- Errors may occur because a prescription is never transmitted to a pharmacy, or a prescription is never filled by the patient.

- Physician sampling of medications can contribute to medication errors due to the lack of both adequate documentation and drug utilization review.

FDA looks for ways to prevent medication errors. Before drugs are even able to be approved for marketing, FDA reviews the drug name, labeling, packaging, and product design to identify and revise information that may contribute to medication errors. For example, FDA reviews (FDA, 2019):

- Proposed proprietary (brand) names to minimize confusion among drug names. With the help of simulated prescriptions and computerized models, FDA determines the acceptability of proposed proprietary names to minimize medication errors associated with product name confusion.

- Container labels to help healthcare providers and consumers select the right drug product. If a drug is made in multiple strengths – e.g., 5 mg, 10 mg, and 25 mg, – the labels of those three containers should be easy to differentiate. The label design may use different colors or identify the strength in large bold numbers and letters.

- Prescribing and patient information to ensure the directions for prescribing, preparing, and use are clear and easy to read.

After drugs are approved for marketing in the United States, FDA monitors and evaluates medication error reports. FDA may also require a manufacturer to revise the labels, labeling, packaging, product design or proprietary name to prevent medication errors (FDA, 2019). FDA may also issue communications alerting the public about a medication error safety issue, by way of Drug Safety Communications, Drug Safety Alerts, Medication Guides and Drug Safety Podcasts (FDA, 2019). FDA collaborates with external stakeholders, regulators, patient safety organizations such as the Institute for Safe Medication Practices (ISMP), standard-setting organizations such as the U.S. Pharmacopeia, and researchers to understand the causes of medication errors, the effectiveness of interventions to prevent them, and to address broader safety issues that may contribute to medication errors (FDA, 2019).

4.2.1.2.5 Strategy 5

Strategy five states reducing unwanted variation in healthcare. Unwanted variation is a form of variation that occurs because the patient was not treated per their specific needs (Ferguson, 2017). This variation is responsible for suboptimal outcomes, including increased morbidity and mortality (Ferguson, 2017). Variation in clinical workflow efficiencies, processes, and more is one of the biggest challenges healthcare organizations face in outcomes improvement work (Ferguson, 2017). However, healthcare isn't

unaccompanied, as variation has been recognized across other industries as a common enemy.

Currently in healthcare, it is increasingly recognizing the relationship between reducing variation and improving outcomes. Interventions in order to reduce variation for a targeted process can advance care by creating consistency based on best practices. The industry's evolving data capabilities, such as Late-Binding™ technology, are expanding health systems' ability to reduce variation in delivery (Ferguson, 2017). However, creating new protocols, such as bundles of care and care processes based on best practices, is only one step toward reduced variation. Organizations also need to develop strong analytic solutions to evaluate the effectiveness of these outcomes' improvement initiatives and, perhaps just as importantly, create methods to track the decision-making process and rationale in instances when these initiatives are not followed (Ferguson, 2017).

The ability to identify the type of variation, as well as when it occurs and why, is fundamental for healthcare improvement (Ferguson, 2017). Patients frequently go to clinics or hospitals with variable degrees of difficulty and other unique circumstances. In an article about 'reducing unwanted variation in healthcare clears the way for outcomes improvement', they state that: For example: two patients present to the emergency department (ED) with pneumonia. One has a history of renal failure and severe chronic obstructive pulmonary disease (COPD), while the other has no significant comorbidities. The ED physician will likely treat each patient differently. This can include the use of distinct antibiotics, based on types of bacteria associated with severe COPD. Each patient (the one with renal failure and

COPD, and the one with no comorbidities) may also receive antibiotic treatment at different dosages and frequencies (Ferguson, 2017).

The type of variation described above in which care is changed to serve the needs of a specific patient, is considered appropriate, or intended, variation. Contrariwise, if the above patient with renal failure and COPD were treated in the same way as the patient without these comorbidities (with the same antibiotics at the same dose and frequency), then they might be at risk of another form of variation: unintended, or unwanted, variation (Ferguson, 2017). This form of variation occurs because the patient was not treated per their specific needs. As such, unwanted variation is responsible for suboptimal outcomes, including increased morbidity and mortality (Ferguson, 2017). The opportunity to reduce variation in outcomes improvement work lies in unwanted variation: by working towards data-driven best practices that reduce variation, health systems further quality improvement by taking actions that support better care and reduced cost (Ferguson, 2017).

In outcomes improvement in healthcare, variation threatens quality across processes and outcomes (Health Catalyst Editors, 2021). The health system can be improved in multiple ways such as recognizing where and how inconsistency impacts their outcomes and reduces unwanted variation (Health Catalyst Editors, 2021). The three critical steps that are discussed in the Health Catalyst article for reducing unwanted variation includes: removing obstacles to success on a communitywide level, maintaining open lines of communication and share lessons learned, and decrease the magnitude of variation (Health Catalyst Editors, 2021).

4.2.1.2.6 Strategy 6

Strategy six states to prioritize process measures over outcome measures. Process measures indicates what a provider does to maintain or improve health, either for healthy people or for those diagnosed with a health care condition (AHRQ, 2015). In an article by the Agency for Healthcare Research and Quality, they gave an example of this: the percentage of people receiving preventive services (such as mammograms or immunizations) and the percentage of people with diabetes who had their blood sugar tested and controlled (AHRQ, 2015). Process measures can inform consumers about medical care they may expect to receive for a given condition or disease, and can contribute toward improving health outcomes (AHRQ, 2015). The majority of health care quality measures are used for public reporting are process measures (AHRQ, 2015).

Outcome measures reflects the impact of the health care service or intervention on the health status of the patients (AHRQ, 2015). Examples of this is the percentage of patients who died as a result of surgery (surgical mortality rates) and the rate of surgical complications or hospital-acquired infections (AHRQ, 2015). The Agency for Healthcare Research and Quality state that the outcome measures may seem to represent the "gold standard" in measuring quality, but an outcome is the result of numerous factors, many beyond providers' control (AHRQ, 2015).

The healthcare industry has a tendency to prioritize outcome measures, but outcome measures alone won't help organizations reach their goals of better quality and reduced costs (Health Catalyst Editors, 2021). In its place, health systems must get more granular

with their data by tracking process measures. Process measures makes it possible to recognize the root cause of a health system's failures. These are the checklists for systematically guaranteeing the organization will deliver the right care to every patient, every time (Health Catalyst Editors, 2021).

Process improvement is a constant importance for healthcare leadership as the driver of all health system activities and outcomes (Health Catalyst Editors, 2021). While the industry continues to navigate the unknowns of COVID-19 response and recovery, progressing the processes organizations can control is paramount to meeting pandemic and non-pandemic healthcare needs. Understandings on successful strategies, advanced analytics tool, and proven skillsets can direct process improvement leaders as they continually aim for improved outcomes and patient experience and lower costs (Health Catalyst Editors, 2021).

4.2.1.3 Best Practice 3

Best practice three is the use of technology to reduce healthcare inequities. Health inequities are differences in health status or in the distribution of health resources between different population groups, arising from the social conditions in which people are born, grow, live, work and age (World Health Organization, 2018). Health inequities are unfair and could be reduced by the right mix of government policies (World Health Organization, 2018). Many ground-breaking jumps in health technology have been made in the centuries people have been practicing medicine, however only few have had as much extensive influence or impact

as digital technology. Dramatic improvements in networking and computers have not only expanded options for medical treatments but have also transformed how clinicians perform their jobs (IBM, 2022).

As the healthcare industry faces new challenges, technology solutions are helping leaders to improve performance, increase collaboration across systems and manage costs (IBM, 2022).   As the demands on organizations increase, healthcare technology can streamline processes, automate tasks and improve workflows at a scale that's not possible for humans alone.   As providers at hospitals and health systems embrace value-based health reimbursement models, these solutions are helping healthcare professionals to improve patient care, create better experiences and reduce burnout (IBM, 2022).

4.2.1.3.1 Remote Healthcare/Telemedicine

Telehealth is defined as the digital information and communication technologies to access health care services remotely and manage health care (Mayo Clinic, 2022). These technologies can include computers and mobile devices like tablets and smartphones. A nurse or other healthcare professional can provide telehealth form a medical office or mobile van in rural areas (Mayo Clinic, 2022). Telehealth can also be technology that the health care provider uses in order to improve or support health care services. The goals of telehealth or also called e-health/m-health (mobile health) include the following (Mayo Clinic, 2022):

- Make health care easier to get for people who live in communities that are remote or in the country

- Keep you and others safe if you have an infectious disease like COVID-19

- Offer primary care for many conditions

- Make services more easily offered or handy for people who have limited ability to move, time or transportation

- Offer access to medical specialists

- Improve communication and coordination of care among health care team members and a person getting care

- Offer advice for self-management of health care

During the pandemic, many providers chose to offer appointments through telemedicine. Likewise, the payers also adapted to these changes by offering reasonable reimbursement for telemedicine and providing better billing options (IBM, 2022). Even after the pandemic ends, the technology ecosystems that supports telemedicine will continue due to the convenience and flexibility that is has to offer. Patients, especially those that live in remote locations or those that work outside traditional business hours, appreciate having these extra options in order to connect with their clinicians via video software on a computer or mobile app on their phones (IBM, 2022).

Remote patient monitoring pairs with telehealth when the patient needs to be monitored for certain health conditions. Many technologies allow a provider or health care team to check a patient's health remotely. There are many symptoms and conditions that can be tracked through remote patient monitoring and include: high blood pressure,

diabetes, weight loss or gain, heart conditions, chronic obstructive pulmonary disease, sleep apnea, asthma (Mayo Clinic, 2022). Some examples of these technologies include (Mayo Clinic, 2022):

- Web-based or mobile apps for uploading data to your provider or health care team. For example, if you have diabetes, you may upload food logs, blood sugar levels and drugs that a nurse checks.

- Devices that measure and wirelessly send data, such as blood pressure, blood sugar and oxygen levels.

- Wearable devices that automatically record and send data. For example, the devices may record data such as heart rate, blood sugar, how you walk, your posture, tremors, physical activity or your sleep.

- Home monitoring devices for older people or people with dementia that can find changes in daily activities such as falls.

- Devices that send notifications to remind you to do exercises or take drugs

4.2.1.3.2 Extended Reality

Extended reality (XR) is defined as the combination of human and computer-generated graphics interaction, which is in reality as well as the virtual environment (Bapodara, 2022). Extended reality is a superset of Augmented Reality (AR), Virtual Reality (VR) and Mixed Reality (MR). Augmented Reality is that virtual objects and imaginations are put up in the real world (Bapodara, 2022).   Augmented reality does not put us into any virtual or computer-generated graphics, but instead creates a sense of illusion in digital

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gadgets (Bapodara, 2022). The users will still have access to the real world as well as be able to fully interact in both dimensions. The most common example of this is Pokémon-GO which used augmented reality so that the users can interact with the real as well as a virtual world with the help of digital gadgets (Bapodara, 2022). Other examples of Augmented reality are the filters that we see in many apps, these just create an illusion of being there, but they are not (Bapodara, 2022).

Virtual Reality (VR) is where the users are put into a fully virtual environment, where they can interact only in the virtual world (Bapodara, 2022). The graphics created are generally computer and artificial objects that are designed to give a feel of being real. The users can feel every bit of virtual reality. Special VR devices are needed to put users into this environment which gives them a 360-degree view of the virtual world (Bapodara, 2022). These devices are designed to give a much real illusion to users (Bapodara, 2022).

Mixed Reality (MR) is a combination of both AR & VR, where one can interact with the digital as well as the real world simultaneously (Bapodara, 2022). Users can visualize their surroundings in special MR devices kind of like the devices used in VR except they are more powerful and cost more (Bapodara, 2022). However, these devices give you the power to interact with the surroundings digitally. For example, putting on an MR device will give you a view of your entire surroundings (Bapodara, 2022). You can do whatever you want, throw a ball, close the windows, etc. which will be digitally in your MR headset, but in actual reality, things will remain as they are (Bapodara, 2022). Many companies are investing a huge amount of money for deeper research in this field of reality.

Even though these devices are handy especially in the healthcare field, there are challenges with cost, hardware, and privacy. The cost is the most challenging as many of these devices are very expensive. The cost is high due to the fact that these technologies work together and there is a lot of hardware that goes into the making of these types of devices (Bapodara, 2022). Another challenge is the hardware. Developing the hardware of XR devices has a lot of components, software and technologies associated with it and making the hardware is a difficult process (Bapodara, 2022). And last, privacy will be faced by users and the companies. The XR devices are required to create an environment base on the user requirement, a lot of private details might be needed to create a user-rich environment (Bapodara, 2022).

4.2.1.3.3 Artificial Intelligence

Artificial intelligence is defined as the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions (Frankenfield, 2022). The ideal characteristic of artificial intelligence is its ability to rationalize and take actions that have the best chance of achieving a specific goal (Frankenfield, 2022). AI in healthcare is an umbrella term to describe the application of machine learning (ML) algorithms and other cognitive technologies in medical settings (Arm, 2022). Artificial Intelligence in healthcare is the use of machines to analyze and act on medical data, usually with the goal of predicting a particular outcome (Arm, 2022). A significant AI use case in healthcare is the use of ML and other cognitive disciplines for medical diagnosis purposes (Arm, 2022). Using patient data and other valuable information, the AI is able to

help make healthcare more predictive and proactive by analyzing big data to develop improved preventive care recommendations for patients (Arm, 2022).

AI applications in healthcare can change a patients' lives, improving diagnostics and treatment and helping patients and the healthcare provider make informed medical decisions quickly (Ologie, 2022). AI in the global healthcare market (the total value of products and services sold) was valued at $2.4 billion in 2019 and is projected to reach $31.02 billion in 2025 (Ologie, 2022). The main goal of AI in healthcare is to improve patient outcomes by transforming treatment techniques by analyzing complex medical data and drawing conclusions without direct human input, AI technology can help researchers make new discoveries (Ologie, 2022).

AI application are playing a huge role in healthcare and its potential future applications are game-changing. There are a couple distinct ways that AI is transforming the healthcare industry (Ologie, 2022). One way is by improving diagnostics. AI technology can help healthcare professionals diagnose patients by analyzing symptoms, suggesting personalized treatments, and predicting risk (Ologie, 2022). AI can similarly detect abnormal results. Healthcare AI can also be used to develop algorithms that make individual and population health risk predictions in order to help improve patient outcomes (Ologie, 2022). At the University of Pennsylvania, doctors used a machine learning algorithm that can monitor hundreds of key variables in real time to anticipate sepsis or septic shock in patients 12 hours before onset (Ologie, 2022).

AI is also advancing treatment. Medical AI is becoming a valuable tool for treating patients. Brain-computer interfaces could assist in restoring the ability to speak and move

in patients who have lost these abilities. This type of technology can also improve the quality of life for patients with ALS, strokes, or even spinal cord injuries (Ologie, 2022). There is probable for machine learning algorithms to advance the use of immunotherapy, which right now only 20% of patients are able to respond to (Ologie, 2022). New technology may be able to determine new options for targeting therapies to an individual's unique genetic makeup. Companies such as BioXcel Therapeutics are working to develop new therapies using AI tools and machine learning (Ologie, 2022).

4.2.1.3.4 Digital Twins/Simulations

Digital Twins is defined as a virtual model designed to accurately reflect a physical object (IBM, 2022). Simulations and digital twins both use digital models to reproduce a system's various processes, a digital twin is actually a virtual environment, which makes it considerably richer for study. The actual difference between digital twin and simulation is a matter of scale: whereas a simulation typically studies one particular process, a digital twin can itself run any number of useful simulations in order to study multiple processes (IBM, 2022).

The differences don't just end there. An example would be: simulations usually don't benefit from having real-time data. However, digital twins are designed around a two-way flow of information that first occurs when object sensors provide relevant data to the system processor and then happens again when insights created by the processor are shared back with the original source object (IBM, 2022). By having better and continually updated data related to a wide range of areas, shared with the added computing power that accompanies

a virtual environment, digital twins are able to study more issues from far more vantage points than standard simulations can, with greater ultimate potential to improve products and processes (IBM, 2022).
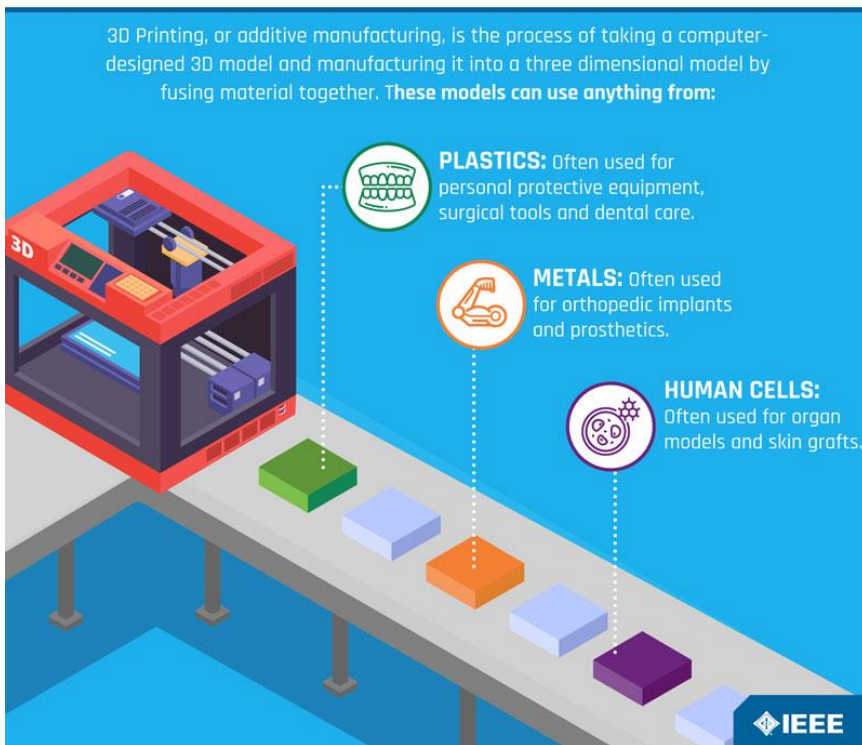
There are advantages and benefits of using digital twins. This includes better R&D – the use of digital twins permits more effective research and design or products, with a plentiful of data created about likely performance outcomes (IBM, 2022). This type of information can lead to understandings that assist companies make needed product refinements before starting production. Greater efficiency – after a new product has gone into production, digital twins can assist with the mirror and monitor of the production systems, with an eye to achieving and sustaining peak efficiency throughout the entire manufacturing process (IBM, 2022).

Product end-of-life – digital twins can also assist manufacturers in deciding what to do with products that reach the end of their product lifecycle and that need to receive the final processing, through recycling or other measures (IBM, 2022). By using digital twins, they can determine which product materials can be harvested (IBM, 2022). While digital twins are prized for what they offer, their usage isn't necessary for every manufacturer or every product created. Not every object is complex enough to need the intense and regular flow of sensor data that digital twins require (IBM, 2022). It may not always be worth it from a financial standpoint to invest significant resources in the creation of a digital twin - keeping in mind that a digital twin is an exact replica of a physical object, which could make its creation costly (IBM, 2022).

4.2.1.3.5 3D Printing

3D printing or additive manufacturing, is the process of taking a computer-designed 3D model and manufacturing it into a three-dimensional model by fusing material together (IEEE Admin, 2022). There are many different types of 3D printing, which use a variety of base materials including: plastics, metals, and human cells. By using these materials, the 3D printer creates them in layers to produce highly complex shapes and designs not possible in traditional manufacturing – see picture below (IEEE Admin, 2022). Due to the flexibility of 3D printing to individualize the products, surgeons can now perform practice sessions on duplicate copies of patient's organs to improve success rates. However, on a different side, doctors can also perform more precisely targeted drug delivery (IEEE Admin, 2022).

MATERIALS USED FOR 3D PRINTING

3D Printing, or additive manufacturing, is the process of taking a computer-designed 3D model and manufacturing it into a three dimensional model by fusing material together. **These models can use anything from:**

PLASTICS: Often used for personal protective equipment, surgical tools and dental care.

METALS: Often used for orthopedic implants and prosthetics.

HUMAN CELLS: Often used for organ models and skin grafts.

◈IEEE

3D printing in healthcare is a growing subsector. Some of these uses have reached global application, but many are still in the research phase. 3D printing of prosthetics, for example, has permitted more reasonable custom prosthetic manufacturing in lower-income communities around the world (IEEE Admin, 2022). The COVID-19 pandemic has reemphasized the need for open-source medical supply designs that can be shared globally and 3D printed locally. Engineers have made personal protective equipment, ventilator supplies and manual tools to help our healthcare providers stay safe and effective as they fight the spread of the disease (IEEE Admin, 2022).

To date, most FDA-reviewed products developed via 3D printing have been medical devices such as orthopedic implants; more than 100 have been reviewed (The Pew Charitable Trusts, 2020). These manufacturing approaches offer several clinical advantages such as manufacturers that have used 3D printing technologies to create devices with complex geometries such as knee replacements with a porous structure, which can facilitate tissue growth and integration (The Pew Charitable Trusts, 2020). 3D printing also offers the capability to create a whole product or device component at once while other manufacturing techniques may require several parts to be fabricated separately and screwed or welded together (The Pew Charitable Trusts, 2020).

Other examples of using 3D printing include but are not limited to: a radiologist, for instance, might create an exact replica of a patient's spine to help plan a surgery; a dentist could scan a broken tooth to make a crown that fits precisely into the patient's mouth (The Pew Charitable Trusts, 2020). In both of these examples above, the doctors can use 3D printing to make products that specifically match a patient's anatomy. 3D printing offers significant promise in the health care field, particularly because of its ability to produce highly

customized products at the point of care. Although there are great benefits on using 3D printing, there are also challenges. As 3D printing is adopted more widely, regulatory oversight must adapt in order to keep pace and ensure that the benefits of this technology outweigh the potential risks (The Pew Charitable Trusts, 2020).

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The main focus on this research paper is to find the best practice models for clinical flow for practical labor purpose in clinics and hospitals. This paper discussed the three practices which included: improving patient flow, healthcare improvement to drive better care at lower costs, and using technology to reduce healthcare inequities.

Chapter one (an introduction) provided the background information to this research topic on best practices. There are many more strategies but for the purpose of this paper I chose three. Best practices are naturally adopted in the absence of efforts to push them into practice. The research problem was introduced in this chapter as well as the statement of the problem, the objectives of the study, and limitations of the study.

Chapter two (theoretical framework and literature review) recognized and discussed literature reviews and articles that were relevant to the topic of this research paper. This chapter also looked at how the various best practice ideas are related among all the research papers and literature reviews as well as the key issues surrounding the topic. It further reviewed and discussed the theory and challenges of Business Process Management as well as the conceptual framework of this paper.

Chapter three (research methodology) discussed the methodology used and analyzed as well as interpreted the data for the three best practices. This chapter discussed the data analysis for each individual best practice: improving patient flow, healthcare

improvement to drive better care at lower costs, and using technology to reduce healthcare inequities along with their subcategories.

Chapter four (findings and results) discussed the findings and definitions of each individual best practice and further explained their subcategories.

This final chapter will go over the conclusion based on the findings of this study. Further recommendations will be stated that may require further investigation and research. To draw this conclusion, the researcher has gathered various information from multiple resources throughout his entire research paper.

5.2 Conclusions

Based on the findings and research of this study, the following conclusions were drawn for each individual best practice. Best practice one is improving patient flow that will impact efficiency. NEJM Catalyst defines patient flow as the movement of patients through a healthcare facility. It involves the medical care, physical resources, and internal systems needed to get patients from the point of admission to the point of discharge while maintaining quality and patient/provider satisfaction (Catalyst, 2018).

Within this best practice one, there were ten tips that were discussed to improve patient flow. These ten included: everyone should share capacity data and ensure the patients arrive or can be transferred to places with sufficient capacity to take care of them, those in the medical field should coordinate the arrival and discharge of patient undergoing elective procedures, establish timely discharge in the morning hours, one way an emergency

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department can increase patient throughout is to consider the layout, and form a patient flow team for quality improvement.

The last set of tips for best practice one included: the team should gain executive support and direction for improving patient flow, explore different staffing models, set goals with attention to patient acuity, use highly-train staff on time management and lastly utilize advanced data analytics.

Best practice two are strategies for healthcare improvement to drive better care at lower costs. Healthcare process improvement is one of the essential drivers of a transformation strategy that aims to improve the quality of care while lowering costs (Health Catalyst Editors, 2022). Within this second-best practice, there were six models that were discussed for these strategies to help drive better care at lower costs.

These six strategies included: transform the delivery of care in the emergency department – mostly due to overcrowding, adopt the six lean methodologies for healthcare improvement – team focused managerial approach, improve hospital patient flow with machine learning, prevent medication errors, reduce unwanted variation in healthcare and lastly, prioritize process measures over outcome measures.

Best practice three is the use of technology to reduce healthcare inequities. Technology has been used to fight various illnesses, develop new vaccines and medicines and help others with a healthier way to live. There have been more and more healthcare companies that are looking at tech companies to help transform the delivery of care through their products and services.

Within this third best practice, I discussed the top five technology that will make a big impact in the healthcare industry. These five included: remote healthcare/ telemedicine - great opportunity as it has a lot of benefits for both the provider and the patient. Extended reality – used in healthcare to train doctors and surgeons by allowing them to get closely acquainted with the workings of the human body without needing to put patients at risk or require medical cadavers. Artificial intelligence – used in the healthcare field in many forms such as: medication timers, speech recognition, patient follow-up alerts, and online diagnoses through chatbots just to name a few. Digital Twins/simulations – in healthcare this can be seen as a digital model of a human body. Lastly, 3D Printing – in healthcare this is seen as printing titanium hip ball and sockets for implants, dental implants, and researchers and scientist are looking at the future of 3D printed drugs and organs like the liver and kidneys.

Based on the above findings, the study concludes that these are the best three practices that both hospitals and clinicals should follow. As healthcare continues to embrace in new technologies, healthcare improvement, and improve patient flow, I believe these practices will improve healthcare quality and patient experience. Providers as well as all medical and non-medical personnel need to concentrate on delivering a high quality of healthcare and foster patient safety in order to improve patient experience.

5.3 Recommendations

In view of the findings, the following recommendations are therefore proposed;

1. In the healthcare field, everyone should deliver high quality of care to patients

2. Better care in the healthcare field with lower cost is possible

3. Hospitals and clinics should focus on the Six Lean Sigma as it is a team-focused managerial approach to improve performance by eliminating waste and defects and has been proven to be successful

4. Each organization/department should look into improving their hospital patient flow with machine learning – this can reduce patient wait times, reduce staff overtime, improve patient outcomes, and improve patient and clinician satisfaction

5. Prevent medication errors – take the time needed to review medications. This will save a lot of money as well as patients' lives

6. Learn more about technology – technology has been used to fight various illnesses, develop new vaccines and medicines and help patients live a better life

7. Invest in telemedicine and remote healthcare if not done so already – many benefits here for both provider and patient

8. Learn more about extended reality (augmented and mixed reality) – these are used to train doctors and surgeons by allowing them to learn more on how things work in the human body without the need of a cadaver

9. Learn more about 3D printing – prosthetics being 3D printed is becoming more popular due to the digital functionalities and being able to match each individual patient

10. 3D printing for presurgical planning – using a realistic replica of an actual patient's anatomy will allow the surgeons to attempt procedures they won't have previously been able to