Resilience During Times of Disruption: The Role of Data Analytics in a Healthcare System

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Abstract

The COVID-19 pandemic has triggered an unprecedented transformation in society, disrupting daily life, businesses, and healthcare systems. This paper explores how organizations, particularly a healthcare institution, can demonstrate resilience amidst these challenges. The swift adaptation to changing conditions, implementation of new technologies, and strategic shifts in response to market changes underscores the importance of resilience and dynamic capabilities. In healthcare, the rapid adoption of telemedicine, reorganization of hospital operations, and implementation of new protocols highlight the need to quickly reconfigure when faced with dynamic change. Amidst such uncertainty, effective information processing, supported by data analytics, emerges as a critical survival tool. This paper applies the frameworks of dynamic capability and organizational resilience to examine how data analytics can aid organizations during major disruptions. By leveraging analytics, organizations can gain insights to inform strategies and maintain operations. To do so, it presents evidence from how a hospital system used analytics to enhance resilience and adaptability during the pandemic, providing insights into managing major disruptions.

Keywords: Data Analytics, Dynamic Capability, Resilience, Healthcare Analytics, Disruption, Pandemic

1. INTRODUCTION

The COVID-19 pandemic has precipitated a profound transformation across all strata of society, creating a pace of change that is unparalleled in contemporary history. The rapid spread of the virus and the subsequent lockdowns disrupted daily life, forced businesses to adapt or close, and put immense pressure on healthcare systems worldwide (Nicola et al., 2020). Businesses across sectors had to quickly adapt to new ways of working, quickly adopt new technologies and processes to support remote work and daily operations, while also addressing challenges related to communication, collaboration, and employee engagement (Bartik et al., 2020). They had to rethink strategies and operations to survive in a rapidly changing environment (Kramer et al., 2020). Surviving disruption required a high degree of adaptability and flexibility, as well as the ability to leverage digital technologies effectively.

In addition to operational changes, many businesses had to rethink their strategies in response to changes in the market. For example, retailers had to shift to online sales as physical stores were closed, while manufacturers had to adjust their production lines to meet changes in demand or to produce essential supplies (Kaplinsky & Utecht, 2020). These strategic shifts required a strong sensing capability to identify

changes in the market, as well as a seizing capability to respond to these changes effectively.

Healthcare organizations faced particularly severe challenges. Hospitals had to manage an influx of patients, protect their staff, and deal with shortages of essential supplies. Hospitals had to rapidly adapt their operations and care delivery models to respond to the crisis (Ranney et al., 2020). This required significant changes such as the use of telemedicine and more broadly telehealth, the reorganization of hospital wards, and the implementation of new protocols for infection control (Greenhalgh, Wherton, Shaw, & Morrison, 2020). These changes required a high degree of reconfiguring capability, as well as strong leadership and coordination.

In periods of such profound uncertainty, the ability to process information effectively becomes a critical survival tool for organizations. As posited by Galbraith (1974), organizations can mitigate uncertainty by augmenting their capacity to process information, which entails the collection and analysis of data to inform decision-making and action. Data analytics infrastructure and tools enable an organization to increase its information processing capacity in the face of uncertainty (Behl, Gaur, Pereira, Yadav, and Laker, 2022; Zhu, Song, Hazen, Lee, and Cegielski, 2018).

In the face of real time dynamic change and disruption such as a pandemic, analytics can be specifically useful. The frameworks of dynamic capability and organizational resilience provide theoretical lenses through which the role of enhanced information processing, supported by analytics, can be examined in the context of major disruptions, such as a pandemic. These frameworks offer a perspective on how to compete and survive when faced with rapid change. By gathering and analyzing data, organizations can gain insights that inform their strategies and actions, enabling them to adapt to changing circumstances and maintain their operations (Chen et al., 2012).

This paper uses the principles of dynamic capability and organizational resilience to explore how a hospital demonstrated resilience during the pandemic and continues to strive to attain agility and competitive advantage using analytics when faced with change. The paper hopes to provide valuable insights into how organizations can leverage analytics to enhance their resilience and adaptability in the face of major disruptions. The rest of the paper is organized as follows. First background information on data analytics, dynamic capability and organizational resilience is presented. Next the hospital system, its use of analytics infrastructure is anonymized in the description of the actual hospital that was investigated. This is followed by a discussion of how analytics enables dynamic capability and organizational resilience at the hospital. Finally, recommendations and conclusions are discussed.

2. DATA ANALYTICS

Data analytics can play a crucial role in enhancing organizational resilience and combating dynamic change in several ways. Data analytics is the process of examining, cleaning, transforming, and modeling data to discover useful information, draw conclusions, and support decision-making (Watson, 2014). It employs various techniques and methodologies drawn from fields such as mathematics, statistics, computer science, and information science, including signal processing, probability models, machine learning, statistical learning, data mining, database systems, and visualization, among others (Kelleher & Tierney, 2018). There are several types of data analytics, including descriptive, predictive, and prescriptive analytics. While descriptive analytics involves analyzing historical data to understand what has happened in the past, predictive analytics focuses on forecasting future outcomes based on historical data and analytics techniques. It uses statistical models and forecasting techniques, as well as machine learning techniques to predict the future (Shmueli & Koppius, 2011). Prescriptive analytics aims to provide advice based on the results of descriptive and predictive analytics using techniques such as optimization, simulation, decision tree, and complex event processing, among others (McAfee & Brynjolfsson, 2012).

The demand for data analytics across various industries today is unprecedented. The technology, finance, healthcare, and marketing sectors are leading the charge, using data analytics to drive decision-making, enhance customer experiences, and streamline operations. According to a report by Market Research Future, the data analytics market is projected to grow from 7.03 billion dollars in 2023 to 303.4 billion dollars in 2030 at a compound annual growth rate of 27.6 percent (Market Research Future, 2023). This surge reflects the growing reliance on data to understand market trends, predict consumer behaviors, and inform strategic decision-making. The rapid growth in big data and advancements in machine learning algorithms have accelerated the use of predictive analytics, a segment that is experiencing the

sharpest increase in demand. According to Statista, the predictive analytics market is set to reach 21.5 billion dollars by 2025, up from 4.56 billion dollars in 2017 (Statista, 20200. Data analytics has had a tremendous impact in the healthcare sector. It is predicted that the healthcare analytics market will reach 50.5 billion dollars by 2024, up from 14 billion dollars in 2019 (MarketsandMarkets, 2020).

The unprecedented challenges the healthcare industry faced worldwide due to the COVID -19 pandemic led to a surge in the use of data analytics in that field. Analytics played a critical role in managing the crisis and strengthening healthcare systems. The rapid spread of COVID-19 necessitated quick and informed decision-making. Healthcare organizations used data analytics to predict virus spread, allocate resources, and identify vulnerable populations (McKee et al., 2020). For example, the University of Virginia Health System developed a predictive model to anticipate COVID-19 case numbers and manage its resources accordingly (Rosenbaum, 2020). Public health surveillance was also enhanced through analytics by helping track and monitor the spread of the virus in real-time. Google and Apple, for example, developed a contact tracing app that used anonymized data to alert people if they had been in contact with a confirmed case (Ferretti et al., 2020). Finally, hospital systems relied on real-time data analytics to manage the rapid expansion of telemedicine that occurred during the pandemic. Healthcare providers used analytics to help monitor patients remotely, identify those at risk, and decide the appropriate level of care. A team at Johns Hopkins used data from wearable devices to predict early symptoms of COVID-19, allowing for quicker interventions (Radin et al., 2020). Data analytics emerged as a vital tool in the healthcare industry's response to the massive disruption caused by the pandemic. In the literature review, two lenses are described that provide more input on how analytics can be utilized to handle disruptive change.

3. LITERATURE REVIEW

Dynamic Capability View (DCV)

The dynamic capabilities theory, introduced by Teece, Pisano, and Shuen (1997), revolves around the concept that a firm's competitive advantage hinges on its ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments. The framework is rooted in the resource-based view (RBV) of the firm (Barney, Wright, and Ketchen 2001), but adds dynamism to explain how firms can achieve sustainable competitive advantage in volatile markets. While RBV suggests that unique, valuable, rare, and non-substitutable resources provide firms with competitive advantage, dynamic capabilities view (DCV) expands this by highlighting the importance of the firm's ability to constantly adapt, integrate, and reconfigure its resources and capabilities according to the ever-changing business landscape.

Teece et al (1997) introduces three types of dynamic capabilities: sensing, seizing, and transforming. Each can play a significant role in helping a firm navigate the rapidly changing business environment. Sensing refers to the capability of a firm to identify and discover opportunities and threats in its environment. It involves the ability to continuously scan, learn, and interpret signals from the environment including changes in technology, competition, markets, and customer needs (Teece, 2007). This process requires a systematic approach to market research, trend analysis, and the detection of emerging patterns. Effective sensing also implies a good understanding of customers, their needs, and their behavior (Teece, 2016).

Once an opportunity is identified, seizing involves designing and refining business models to capture and exploit these opportunities. It involves aligning or reconfiguring the firm’s resources and capabilities with the opportunities sensed. This includes strategic decision-making processes, designing business models, coordinating resources, and defining organizational structures (Teece, 2007). Effective seizing often requires strong leadership and a supportive organizational culture that fosters innovation and risk-taking (Teece, 2012). An organization commits resources to the identified opportunities and builds new capabilities to gain a competitive advantage.

Transforming capabilities relate to a firm's ability to revamp its resource base to meet the requirements of a changing business environment. This could involve reconfiguring the firm's structure, resources, routines, or even its culture. Transformation often requires firms to unlearn obsolete practices and learn new ones, which is particularly challenging given the resistance to change that is often encountered within organizations (Teece, 2018). All three capabilities are deeply interconnected and need to be balanced for a firm to successfully navigate a dynamic business environment and achieve sustainable competitive advantage.

Dynamic capability view is a theoretical framework that has been widely applied in the field of information systems (Bozic, and Dimovski, 2019; Mikalef, Boura, Lekakos, and Krogstie 2019; Matarazzo, Penco, Profumo, and Quaglia, 2021). In the context of IS, dynamic capabilities can be seen as the firm's ability to leverage its IT resources and competencies to respond to changing environments. This includes the ability to develop new IS, adapt existing systems, and integrate systems to meet changing business needs (Wang & Ahmed, 2007). The DCV has been used to explain how firms can gain a competitive advantage through the strategic use of IS. For example, firms with strong dynamic capabilities can leverage IS to create new products or services, improve business processes, and enhance decision-making capabilities (Pavlou & El Sawy, 2006).

Analytics and DCV

Enabling dynamic capabilities within organizations by using data analytics, allows organizations to not only respond to changes in their environment but also shape those changes to their advantage. Sensing capabilities might involve the use of data analytics to detect market trends and customer preferences. For example, Netflix uses data analytics extensively to understand viewing patterns and preferences, which helps them to identify trends and opportunities for new content creation (Cortez, Bonnet, & Boulanger, 2021). Organizations that are effective at seizing opportunities use analytics to capture value from the opportunities they have sensed. For instance, Amazon uses its recommendation systems (powered by machine learning algorithms) to seize opportunities by providing personalized recommendations based on customer's browsing and purchasing history (Lu, Shambora, & Lu, 2015). Transformation or reconfiguration involves changing an organization's operations and strategies in response to sensed opportunities or threats. For example, IBM, facing declines in its hardware business, leveraged information systems to reconfigure its capabilities around services and software. They invested in analytics and cognitive computing, leading to the development of Watson, an AI system, redefining IBM's value proposition in the market (Mithas, Tafti, Bardhan, & Goh, 2012).

Organizational Resilience

Organizational resilience is the ability of an organization to anticipate, prepare for, respond and adapt to incremental change and sudden disruptions in order to survive and prosper (Duchek 2020). It embodies more than just the ability to bounce back from adversity; it includes an organization's capacity to anticipate and respond to changes, as well as its ability to transform itself when necessary (Lee, Vargo, & Seville, 2013). It is a proactive approach to identifying potential risks and vulnerabilities, as well as implementing strategies and measures to mitigate their impact. From a process-oriented view, organizational resilience can involve an anticipation stage, coping stage and adaptation stage.

The anticipation stage involves identifying potential threats, estimating their potential impact, and taking proactive measures to prevent or minimize potential harm (Weick & Sutcliffe, 2007). At this initial stage, the organization must be aware of its environment and keenly observe for changes that might indicate potential threats or opportunities (Weick & Sutcliffe, 2007). Once potential disruptions have been identified, preparation is required. This involves designing strategies and action plans to mitigate the identified risks. Preparation may involve creating contingency plans, strengthening existing structures, and investing in technologies or practices that enhance resilience (Linnenluecke, 2017). Moreover, resources must be made available or reserved for potential use during a crisis. These resources could be financial, such as emergency funds; physical, such as additional inventory or backup equipment; or human, such as extra personnel or expert teams. An organization's preparedness and resource availability are vital in determining its ability to respond to and recover from disruptions (Hosseini et al., 2016). Organizations that excel in this stage tend to have a culture of preparedness and a strong emphasis on continuous learning.

Coping is the organization's immediate response to a disruption. It involves managing the crisis to minimize harm and stabilize the situation as quickly as possible (Boin & McConnell, 2007). This stage involves accepting the situation, developing and implementing solutions, and leveraging social resources (Williams et al., 2017). Denial or delay in acceptance can exacerbate the impacts of the crisis. Hence, acknowledging the situation is critical for organizations to quickly and effectively mobilize their resources and enact their response plans (Horney et al., 2010). In addition, the utilization of social resources is a key aspect of this stage. These resources include relationships with stakeholders, collaborations with other organizations, and the support of the wider community. This often requires decisive leadership, effective communication, and rapid decision-making. Resilient organizations have

systems and procedures in place that allow them to respond effectively in a crisis, such as emergency response teams and crisis management plans (Weick, Sutcliffe, & Obstfeld, 2005).

The adaptation stage involves learning from the disruption and making changes to avoid similar situations in the future or becoming better prepared for them (Lengnick-Hall et al., 2011). After managing a disruption, organizations must reflect on the crisis and its handling to extract valuable lessons. This process of reflection facilitates learning, enabling organizations to identify what worked well, what did not, and how they could improve their response in the future. This learning is critical to evolving the organization's practices, systems, and strategies to enhance its resilience (Linnenluecke, 2017). This could involve making changes to processes, systems, or structures, or it could involve a broader cultural or strategic shift (Hosseini et al., 2016). Adaptation also involves recognizing and redefining roles, power structures, and responsibilities within the organization. Leadership plays a crucial role in driving and managing change, but resilience also requires the engagement of employees at all levels. It involves creating a culture of resilience, where each member understands their role in managing disruptions and is empowered to act when necessary (Bhamra et al., 2011). Resilient organizations are not only able to bounce back from a disruption, but they are also able to learn and grow from it, emerging stronger than before (Sutcliffe & Vogus, 2003). The process of organizational resilience is an ongoing and cyclical process of anticipation, coping, and adaptation. Each stage is crucial and interdependent, forming the backbone of a resilient organization that can survive and thrive amidst disruptions.

Analytics and Organizational Resilience

Data analytics can provide businesses with meaningful insights that can be used to improve decision-making, optimize operations, improve customer service, and increase profitability, among other things. Therefore, analytics can enhance an organization's ability to anticipate and prepare for potential disruptions. By analyzing historical data and using predictive analytics, organizations can forecast potential risks and disruptions, and develop contingency plans accordingly (Araz, Choi, Olson, and Salman, 2020). For example, in supply chain management, predictive analytics can be used to anticipate potential disruptions and develop risk mitigation strategies (Ivanov, Dolgui, Sokolov, Ivanova, & Strandhagen, 2019).

Analytics can also enhance an organization's ability to respond to or cope with disruptions. Real-time data analytics can provide organizations with timely and accurate information during a crisis, enabling them to make informed decisions and respond effectively (Ransbotham, Kiron, & Prentice, 2015). For instance, during the COVID-19 pandemic, many organizations used real-time data analytics to monitor the impact of the pandemic on their operations and adjust their strategies accordingly (Verma & Gustafsson, 2020). Finally, data analytics can enhance an organization's ability to adapt to changes and disruptions. By analyzing data on the impact of disruptions, organizations can identify areas for improvement, learn from their experiences, and adapt their strategies and operations accordingly (Barton, Castillo, Petrie, & Wardell, 2019). This can enhance the organization's resilience and its ability to recover from disruptions.

The dynamic capability view and organizational resilience are closely related concepts that both focus on an organization's ability to adapt to changes and disruptions in the business environment. While organizational resilience primarily focuses on surviving disruptions and returning to a baseline, DCV focuses more on strategically adapting and growing amidst changing environments. The sensing, seizing, and transforming capabilities of DCV appear to align closely with the anticipation, coping, and adaptation stages of organizational resilience. However, DCV is more focused on strategic management and is a more proactive and forward-looking approach which emphasizes creating and shaping opportunities and not simply responding to the external environment. Organizational resilience can also be seen as an outcome or manifestation of dynamic capabilities. By effectively sensing, seizing, and transforming, organizations not only can gain a competitive advantage, but they can also become more resilient to disruptions (Vogus & Sutcliffe, 2007; Weick & Sutcliffe, 2007). By developing their dynamic capabilities, organizations can enhance their resilience, allowing them to effectively anticipate, respond, and adapt to disruptions and changes in their environment. Understanding and viewing the world through both lenses together can help an organization better navigate complex, volatile environments to either bounce back from adverse events or the strategically adapt to new opportunities.

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4. ABC CHILDREN'S HOSPITAL SYSTEM

ABC children's hospital, located in the Midwest, provides pediatric services to area children and is an institution that has gained national recognition for high quality care provided. ABC hospital has a strong commitment to technological innovation which is ingrained in its mission to adopt and implement new technology in pursuit of helping children in the region. The recent pandemic outbreak of the COVID-19 virus forced the hospital to re-evaluate the technology choices and methods employed for treating patients.
Prior to the pandemic, ABC was beginning to expand its IT infrastructure to a complex network of software and systems, professionals, and strategies aimed at harnessing and analyzing data for better decision-making and improved patient outcomes. As part of this strategy, it offered telehealth services in a limited capacity. As the pandemic began to spread, ABC significantly ramped up their ability to effectively deliver medical services via telehealth applications to limit patient and medical provider risk due to the COVID-19 outbreak. ABC was able to quickly connect its telehealth services to its rapidly evolving data and analytics infrastructure in order to give hospital personnel more information to make decision under rapidly changing conditions. The data and analytics architecture at ABC during the pandemic is presented in figure one. The overall architecture can be described in terms of several key components and ongoing processes.

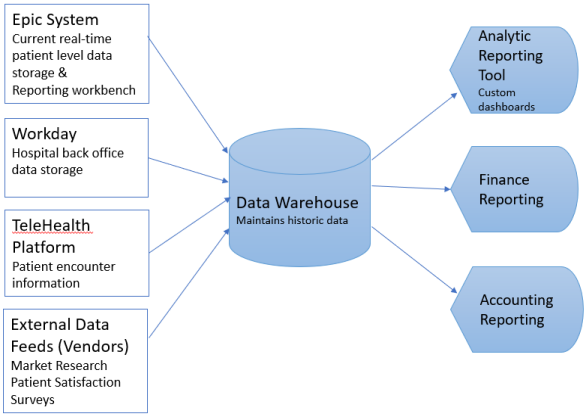

Figure 1: IT and Analytics Architecture

Core Systems: At the center of the architecture is the EPIC electronic medical records system, which is integral to nearly all operations and decision making. Individuals working with EPIC and information systems in clinical areas develop and maintain data required for all stakeholders. In addition, Workday is a back-office system used for hospital administrative support functions like accounting, HR, supply chain. Together with EPIC, the Workday helps run and stores data on day to day operations.

Data Warehousing and Storage: Internal data stores are managed to facilitate long term reporting allowing for the analysis of several years of historical data. While internal data stores are currently in place, there is discussion of implementing cloud storage in the future.
Reporting and Analytics: An analytics platform enables real time reporting using data sourced from EPIC. However, these reports are typically limited to recent history to maintain speed for active patient care. For long-term reporting, different divisions such as Finance and Accounting use specific applications. All these applications are housed within a business intelligence department which was later rebranded as a centralized analytics division called Decision Analytics Division that is also responsible for developing and communication information to the executive team of the hospital.

Vendor Partnerships and Integration: ABC hospital collaborates with various analytics and market research companies, to obtain market forecasts, strategy analysis and patient satisfaction surveys. The challenge lies in centralizing the data from these diverse sources, and the hospital is actively working towards streamlining this process by investigating the possibility of integrating a centralized data analytics tool such as Power BI to disseminate information. Unfortunately, this process has challenges due to a lack of expertise and the need for significant manual data import.

Telehealth Implementation: The hospital has adopted telehealth as a strategic initiative by partnering with Zoom to integrate with the EPIC system. The hospital's strategy aims to record telehealth visits directly into patients' medical records, eliminating manual documentation. Strategy is being developed to integrate telehealth into its existing analytics strategy, which will be crucial in the post-COVID-19 era.

The adoption of telehealth in hospitals has surged in recent years, particularly in response to global events like the COVID-19 pandemic. It has been used to deliver a variety of healthcare services remotely, from routine checkups to specialist consultations, improving accessibility, efficiency, and potentially even the quality of care (Hollander & Carr, 2020). Patients were not only able to connect with their doctors for COVID-19 related concerns but also for managing chronic

conditions, mental health services, and preventive health consultations.

Data analytics plays a critical role in telehealth by providing opportunities to improve patient outcomes, increase efficiency, and transform the way care is delivered (Wade, Eliott, & Hiller, 2014). On a basic level, data analytics in telehealth involves the collection, analysis, and interpretation of health-related data. With large volumes of data being collected through telehealth platforms, there is a need for robust data management systems to store, manage, and protect this data in a manner that ensures the confidentiality, integrity, and availability of patient data, in accordance with legal and ethical requirements (Hilty et al., 2020). This data can include patient-reported outcomes, clinical measurements, and other data collected through telehealth technologies (Dixon, & Simon, 2020). These data can be analyzed to monitor patient progress, identify trends and patterns, and inform clinical decision-making. For example, predictive analytics can be used to identify patients who are at risk of hospital readmission or to predict disease progression, enabling early interventions that can improve patient outcomes (Shi et al., 2020). Similarly, telehealth data can be used to evaluate the effectiveness of different treatments, informing evidence-based practice (Wade, Eliott, & Hiller, 2014).

5. DISCUSSION

As disruption and change began to overwhelm society and the hospital system, ABC children's hospital began working with its existing IT and analytics infrastructure as well as ramping up new capabilities to face the onslaught of patients and care services required. It used its current analytics framework to analyze data and identify trends that might impact its operations. The ability to use EPIC and its analytics platform allowed the hospital to gain insights into patient behavior, market trends, and more. The sensing capability also extended to monitoring feedback from patient satisfaction surveys, market research data, and other sources to make informed decisions about hospital operations and strategies.

Once opportunities or threats were sensed to its existing operations, the hospital began shifting to implementing new technologies and practices based on the insights gained from their analytics. The rapid deployment of telehealth in response to COVID-19 demonstrates the hospital's ability to sense a need for a shift in healthcare delivery methods and how it seized this opportunity. Further, the incorporation of telehealth data to with existing EPIC data to gain comprehensive patient-level data for decision-making shows how the hospital is leveraging analytics infrastructure to seize opportunities for operational efficiency and financial management.

Transforming involves the adaptation or reconfiguration of the organization's operations and processes to suit the changes it has sensed and seized. ABC hospital demonstrates this capability by rebranding its business intelligence department to Decision Analytics Division, indicating a shift in its function to provide more operational and executive decision-making support. The potential shift to cloud storage for data and ongoing efforts to consolidate data reporting into centralized locations suggests ongoing efforts to transform their information management strategies.

At the time of investigating ABC Children's hospital, it shows signs of being in the coping stage of its organization resilience journey. The hospital has experienced significant growth, expanding its clinical staff and service providing locations including the expansion of IT infrastructure indicating an adaptation to the increasing demands of data management and analytics. Having sensed future needs, they took a proactive approach to accommodate growth. The addition of new employees and the establishment of the Decision Analytics Division demonstrate the hospital's efforts to enhance its analytics capabilities. This indicates that the hospital is actively responding to the need for data-driven decision-making. The centralize data delivery and governance developed through the creation of the Decision Analytics Division helps provide organization-wide confidence in a single source of truthful answers. This step has enhanced the efficacy of data management, providing a reliable foundation for strategic decisions to be grounded in data analytics, moving away from gut-based decisions that were more prevalent in earlier practices. Consequently, the hospital landscape is seeing an evolving focus on analytics and the development of data-driven teams in different functional areas.

The hospital relies on EPIC as core system that manages its electronic medical records system. Most decision making at all levels revolve around this core system. This indicates a level of stability and integration in the hospital's analytics ecosystem. The hospital has formed partnerships with analytics companies to enhance its analytics capabilities. This suggests that the hospital is seeking external expertise and resources to adapt

to the evolving analytics landscape in times of rapid change. Finally, having sensed the need for a new means of service delivery in light of the COVID-19 pandemic, the hospital recognized the importance of telehealth services. The rapid implementation of telehealth and the need for a robust analytics strategy for monitoring and improving telehealth options indicate the hospital's ability to respond to sudden and disruptive changes, which is characteristic of the coping stage.

However, it is worth mentioning that while they appear to be in the coping stage, there are elements of anticipation and adaptation present as well. They are anticipating future needs for cloud storage, more robust telehealth infrastructure, and improved data analytics. They have also shown elements of adaptation by taking steps to integrate, consolidate and streamline disparate systems and vendors with their own reporting solutions to an integrated data analytics and visualization solution. Challenges like the lack of automation and expertise with an analytics and visualization tool like Power BI suggest that the adaptation process is still early in its progress. Overall, these efforts showcase that ABC hospital is actively working on resilience by integrating technology, investing in analytics, adapting to changing healthcare practices (like telehealth), and maintaining a focus on patient experience and market trends. Further examination of analytics practices through the lenses of DCV and organizational resilience suggests the following recommendations that ABC could adopt.

(1) Implementation of a data analytics solution such as Microsoft Power BI to support hospital wide decision making. Conduct a thorough assessment of the organization's data infrastructure, security protocols, and gateway access to identify and address capacity limitations and roadblocks. Hire individuals with experience in data management and the analytics tool such as Power BI to effectively manage and optimize the data behind the tool, ensuring efficient data integration, transformation, and visualization.

(2) Expand the centralized data governance framework developed through the analytics division that clearly defines roles, responsibilities, and sources for each type of information to deal with conflicting data in disparate sources. Implementation of data quality control measures, such as data validation and standardization, to ensure consistency and accuracy across reports and data sources.

(3) Development of a comprehensive training program and adoption plan for an analytics application such as Power BI that caters to different user groups, including leaders with varying computer skills. Promote data literacy and data-driven decision-making across the organization to continue to foster a culture of data-driven collaboration. Offer continuous learning opportunities, such as webinars or online resources, to keep staff updated with the latest features and best practices in Power BI.

(4) Strengthen deployment of surveys and feedback mechanisms to collect patient satisfaction data regarding telehealth services. Analyze provider feedback to identify pain points, challenges, and areas for improvement in telehealth implementation. Identify metrics to evaluate the impact of telehealth on provider efficiency, patient outcomes, and overall satisfaction.

(5) Collaborate with stakeholders to define key performance indicators (KPIs) and metrics relevant to telehealth success, such as appointment volume, cancellation/no-show rates, percentage of telehealth visits, patient satisfaction scores, and financial data.

(6) Develop a centralized dashboard that integrates data from various sources to provide a comprehensive view of telehealth performance. Utilize data visualization techniques to present the metrics in an intuitive and actionable format, allowing stakeholders to monitor trends, identify areas for improvement, and make informed decisions.

(7) Leverage analytics to conduct cost analyses, such as cost of illness analysis, cost-effectiveness analysis, or cost-benefit analysis, to evaluate the economic impacts of teleconsultations and telemedicine applications. Develop models that consider utilization levels, cost structures, and potential cost savings associated with telehealth implementation. Utilize data visualization and storytelling techniques to effectively communicate the economic benefits of telehealth to stakeholders, supporting strategic decision-making and resource allocation.

By implementing these solutions and leveraging analytics, ABC hospital can become more resilient and continue to hone its dynamic capabilities to meet changes and attain competitive advantage.

6. CONCLUSION

Faced with a major disruption such as a global pandemic, many organizations had to scramble and rapidly change to survive and conduct its day to day operations. Increasing information processing capacity through investment in information technology such as data analytics helped companies to combat change. Dynamics capability view and organizational resilience offers lenses to consider how analytics can improve and effectively deal with rapid change and disruption. At ABC Children's Hospital, implementation of telehealth integrated with decision support structures and analytics enabled that them to successfully navigate and survive the worst of the pandemic. Analytics enabled ABC to gain dynamic capability and cope with the disruption resulting from the pandemic. Dealing with disruption led to an estimated 8.8 percent loss of working hours worldwide which is equivalent to 255 million full-time jobs (International Labour Organization, 2021). Analytics can be one of the many tools that organizations can use to survive massive change as well as black swan events such as the Covid-19 pandemic.

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