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The Impact of Supply Chain Preparedness on Healthcare Service Quality: A Literature Review

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ABSTRACT

Numerous studies in the field of measuring the quality of service in healthcare have been conducted; however, researchers have not reached a consensus on the critical factors that are sufficiently rigorous to link and measure the healthcare service quality based on the supply chain preparedness. This has triggered the need to review the literature pertaining to the impact of supply chain management and preparedness on healthcare service quality to draw lessons from the literature. The studies that have been published between the period of 2015-2020 were reviewed. Two authors independently reviewed the eligibility of the studies, extracted data from the included studies, and appraised the risk of bias and quality of the study. The purpose, methodology, results, and recommendation of all the selected articles have been critically analyzed and synthesized. Based on the evaluation and analysis of the articles, it is evident that there are different factors that play the diverse roles of determinants and barriers of implementing a responsive supply chains in the healthcare system in order to improve and maintain healthcare services. It is examined through the study of different articles that by taking certain crucial factors into consideration. Different studies highlight different aspects that are crucial towards understanding the implications, benefits, as well as barriers and challenges of implementing supply chain management in the healthcare system and how it is the future of lean and agile supply chains in order to amplify and improve the healthcare service quality.

1. INTRODUCTION

The healthcare supply chain management (SCM) has transformed substantially in the last several years, especially during the COVID-19 pandemic. Factors such as pressure to deliver more efficient health services, the growing impact of patient associations, and increased competition have contributed that numerous healthcare organizations initiate projects in the area of patient logistics [1]. One critical lesson from the COVID-19 is the importance of supply chain preparedness. More precisely, this preparedness is paramount for saving millions of lives worldwide. The supply of essential medicines and services is highly complex and includes a variety of functions in addition to manufacturing, such as forecasting, procurement, distribution, and delivery [2].

In the early days of the pandemic, numerous countries encountered difficulties regarding forecasting, quantifying, and sourcing essential medicines, ventilators, and PPE, which led to increased mortality and morbidity. During the pandemic, mortality and morbidity have likely increased due to weaknesses in supply chain. The primary objective of the healthcare supply chain is to save lives, which implies that it must be projected in a patient-based logic. Accordingly, medicines and materials management have become critical factors in enhancing improving healthcare services and efficiently responding to healthcare challenges.

Healthcare supply chain management differs from traditional SCM because it involves a wide variety of items considering numbers of different procedures and diagnosis types [3]. Moreover, a large amount of these items is very expanses and needs specific handling to prevent obsolescence and spoilage [4]. The questions related to benefits and value of investment in establishing the supply chains and its influence on the quality of healthcare services remain. To illustrate, annually, 11 million children younger than five die. Out of the total number, 90% of deaths occur in developing countries and 71% in Africa and Southeast Asia. Importantly, cheap, effective, and available interventions can prevent more than half of these deaths [5].

Supply chain management is still considered a support function, although, after human resources cost, medicines and materials are the second higher expenditure in hospitals [6]. However, to improve healthcare quality and decrease resource utilization, it is critical to redesign hospital services and implement integrated care programmes. Health service operations have been substantially transformed not only in practice; the theoretical perspective has shifted as well. The healthcare sector has been investigated in the last ten years in the fields such as logistics, organizational behaviour, and economics [7-10]. Nevertheless, the knowledge of the healthcare sector in the field of supply chain preparedness is still limited. Therefore, this study aims to review the existing literature on healthcare supply chain and identify the available research gaps. It has been recognised that reviewing the

existing research related to healthcare supply chain shall show researchers and policymakers a direction towards future research to develop effective and efficient supply chain practices in healthcare.

2. METHODOLOGY

The need for this systematic review is justified by identifying current systematic reviews in the information systems, health informatics, and social science databases, including Pub Med, Science direct, ProQuest, Wiley, Sage, EBSCO, Taylor, Springer Link, Emerald, and the ACM. A total of 610 articles were shown in the search results for "supply chain preparedness in healthcare". Out of these, only the ones published between the period of 2015-2020, i.e., in the last five years, were kept for further assessment, and the others were eliminated. As shown in Figure 1, the selection process involves many steps. At the end of this process, a total of 9 empirical studies were selected from the 74 articles according to the following criteria; i) the studies empirically evaluated the SCM in healthcare; ii) the studies clearly identified the research methodology; and iii) complete research findings are available. The first and the second authors independently reviewed the eligibility of the studies, extracted data from the included studies, and appraised the risk of bias and quality of the study [11]. This was done to keep the research as current and relevant as possible. Further, the remaining articles were studied by reading and reviewing their abstracts and conclusions with relation to the research aims and objectives. The purpose, methodology, results, and recommendation of all the selected 9 articles are then studied for engaging in further research processes. For this, each of the final 9 articles were thoroughly studied and fully reviewed, with segregating and arranging them in terms of their addressed topic, research aims and findings.

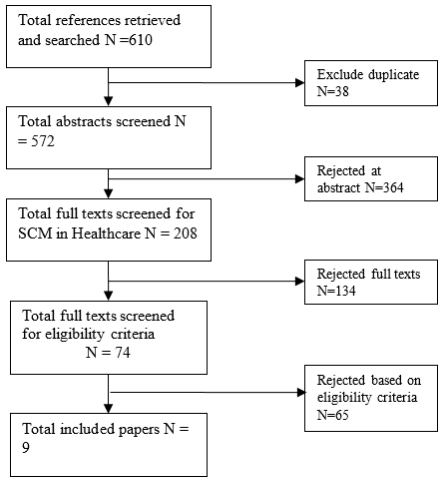

Figure 1. An overview of study selection and exclusion process

3. RESULTS AND DISCUSSION

This section as depicted in Table 1, discusses the importance, theories, results, conclusions and methodologies that were adopted in prior research regarding supply chain management and preparedness in healthcare.

Table 1. Content review of the selected articles

	Author	Purpose	Methodology	Results	Recommendation
1	Carino, Porter, Malekpour, Collins and Dietetics [12]	Identify and synthesize the factors that affect hospital food and nutrition supply chain.	Literature review	The results of the study synthesis show that the strategies focused on reducing food waste and increasing patients' intake can be implemented by various food service models. Though, there are various barriers that have been identified in implementing this process.	Future researchers must investigate the area of measuring environmental impacts and develop ways of testing the effects of sustainable strategies across the stages of procurement, distribution, preparation, and waste management.
2	Denicolai, Previtali and change [13]	Address the gap between the dynamics and Precision Medicines (PM) on organizational and value chain management.	Case study: survey on the multiple case studies	The PM is facing immense challenges in terms of organizational, strategic, and cultural aspects, other than the biomedical. The research findings have significant implications for policymakers.	Greater awareness is required to take further steps from a scientific standpoint.
3	Scavarda, Daú, Scavarda, Korzenowski and Recycling [14]	Analyse the services at the Central Sterilization department and the stockroom in the supply chain process by means of using sustainable lenses.	Exploratory research	It is clarified that the supply chain management in the healthcare possess the ability to make the quality of life better and to provide unique sustainable solutions.	All the healthcare organizations should contribute in their sustainable applications to improve the supply chain process.
4	Uenk, Taponen and Management [15]	Improve the understanding about procurement procedures adopted by the home care service providers. - explained the way that Finland and Netherland manage the services of the home care based on the service triad risk perspective Clarify the link between the suppliers, the buyers, and the end customers.	Mixed Method (Exploratory Research using Qualitative and Quantitative Methods)	Based on the decision made by the buyer and the market supply conditions, this case of the two public bodies Finland and Dutch provide better understanding of facing the risk based on the decisions made by the buyer for outsourcing care services.	The procurement approach used by Finland that is both the in-house provision and the hybrid outsourcing is considered better as it face less risk and provide opportunity for continued development for the actors of the service triad.

5	Vecchi, Cusumano and Boyer [16]	Analyses the contracting challenges that are faced by the Italian healthcare authorities and the officials of US procurement during the COVID-19.	Case study	The results of the comparison and contraction of practices and other relevant aspects to procurement show that there are common challenges involved in the medical supplies contracting of both the countries during the crisis.	Implementation of a new strategic approach to procurement would help in achieving business innovation and resilience, as well as encourage the creation of local-based production, which would in turn help public procurement use and implement the strategic policies.
6	Imran, Kang and Ramzan [17]	To present the multi objective and the multi period model of the supply chain of medicines within the joint healthcare system.	Programming: testing algorithms	The supply chain model of the medicines which explains the most effective use of the cost, quality, and time called together as the business triad inside the healthcare setting. -Numerical example was solved by using fuzzy programming approach. -This approach can convert multi objective problems into the single objective by assigning weights to the medicines.	- The given research is beneficial to be applied in hospitals for contacting the best suppliers for medicine procurement. - implement the vehicle routing system in the supply chain of the medicines during emergency times.
7	Dixit, Routroy, Dubey and Marketing [18]	Review the existing literature on healthcare supply chain (HSC) and to find the gap in it. It has recognised and analysed the existing issues that are relevant to HSC and also showing a direction towards future research to develop effective and efficient HSC.	Literature review	The operations of supply chain, inventory management, performance measurement, use of information technology, and lean and agile operation are studied and analysed, which assert the importance of employee and customer training, cold chain management, visibility and tracking of medicines, waste management, risk management, human resource practices. However, it is also found that not much attention is paid to this important direction.	The outcomes of the studies could be important sources to conduct further studies in the field of lean and agile supply chain in order to amplify and accelerate the performance of HSC.
8	Mathur, Gupta, Meena and Dangayach [19]	Examines the casual linkages between the supply chain practices, supply chain performance effectiveness, and organizational performance in the Indian healthcare organizations.	Literature review	The efficient supply chain performance plays a critical role in the organizational performance improvement of the healthcare industry in India. The study highlights the close interrelationship between supply chain management practices and SCP with the organizational performance improvement.	As the study is focused only on SCP of equipment supply chain and medical devices, further research is required in the other domains of healthcare industry.
9	Landolfi, Menato, Sorlini, Valdata, Rovere, Fornasiero and Pedrazzoli [20]	Proposes an intelligent value chain management framework for customised healthcare devices by focusing on the logic, data model, services, and optimization functions.	System architecture and optimization	The proposed model emphasizes a combination of physical and digital integration a proper manner could provide effective support to the customized manufacturing experiences and operations. The suggested platform has been developed and designed to provide life-long management to the Movement Assisting devices of healthcare services.	Design constraints, along with experts' constraints would help in representing the logic that otherwise delay in awareness creation services.

Supply chain management can be defined as the flow of services, goods, and information starting from raw materials to the end customer [21]. Another definition of a SCM can be referred to a group of institutions which transfers the product to the end customer via suppliers, product assemblers, merchandisers and transportation companies which are the parts of a supply chain [22]. Healthcare supply chain management differs from traditional SCM because it involves a wide variety of items considering numbers of different procedures and diagnosis types [3]. In SCM, tasks and roles must be precisely defined to implement value-added activities across the value chain aspects because downstream, low-value-added, opportunistic efforts are no longer sufficient to enhance the quality of healthcare services. Some studies on the healthcare sector have regarded the Healthcare Supply Chains as more complex compared to SCs in other industries [23-25] considering that the positive influence on patient's health demanding requires highly precise medical supply [25].

Vecchi, Cusumano and Boyer [16], highlight that adopting a new strategic approach of procurement would enable the business to achieve innovation and resilience. It would also encourage the formation of a local production base. In the post COVID-19 fallout phase, there would be more scope and space for the adoption of new public-private partnerships as well as public procurement. Vecchi, Cusumano and Boyer [16], highlight how the excitement towards adoption of innovative and new practices through investment in public sector managerial competence building would result into the fulfilment of unmet promises the previous and existing public-private partnerships.

Uenk, Taponen and Management [15], study develops propositions after making observations regarding the risk allotment while putting focus on the delivery methods as well as supplying services. During the COVID-19 crisis and aftermath, policymakers must reflect on procurement areas that have been comparatively less affected by previous partnerships with market suppliers [16]. For this, the rapidity, flexibility, and business continuity must be compared, based on levels of collaboration. However, flexibility and assurance of outcome could be gained by co-designed solutions [16].

The government manages the hospitals and the medicine supply chain in developed countries [17]. Therefore, in the medicine supply chain, the position of the government must be recognized. The laws and regulations are determined by government policies and strategies in the supply chains for medication. Imran, Kang and Ramzan [17], consider an integrated healthcare system in the proposed study that also includes the government that is the health department of the country. The flow of medicines and information between pharmaceutical companies, health departments, and the hospital network includes this integrated network. According to Imran, Kang and Ramzan [17], there are two main channels in the supply chain of medication. The first channel connects suppliers, manufacturers, pharmacies, and clinics. The second channel ties suppliers, clinics, pharmacies, hospitals, and patients. Although both channels are equally important, except the second one that involves all the actions of the government [17].

From Uenk, Taponen and Management [15] perspective, "The government (public) procurement of home care services for its citizens constitutes a service triad. In a service triad there are three actors are involved: a buyer (the public body); contracts a supplier (a care provider); to deliver services to end-customers (the citizens in need of home care)".

For instance Precision Medicine implications for value and supply chain model might lead to a dramatic rethinking of supply chain systems and also emerge as an innovative form of ecosystem. Imran, Kang and Ramzan [17], and Denicolai, Previtali and change [13] results show that Precision Medicine is facing immense challenges in terms of organizational, strategic, and cultural aspects, other than the biomedical. The research findings also have significant implications for policymakers [17]. Current industrial, administrative, and financial developments in the healthcare structures have given improved treatment for all the patients without any discrimination. Based on the report issued by the World Bank, ''world death rates have been reduced from 17.712 in 1960 to 7.524 per thousand in 2019 [26]. There exist various important factors which are responsible for reduced death rate such as better treatment facilities, access to the medicines, as well as more improved medical facilities. Even with such progress in healthcare, development in the healthcare structure as well as supply chain management is unavoidable. It shows that Precision Medicine leads to a dramatic rethinking of supply chain systems and emerge as an innovative form of ecosystem.

Supply chain management in healthcare is a complex and multi-faceted phenomenon that is based on the novel forms of innovative models and ecosystems [13]. Hence, the process of the procurement and the supply chain in the healthcare setting consists of the stricter assessment of the healthcare suppliers while each of them is assessed based on the quality, supply chain time, manufacturing as well as quality with the appropriate coordination with the healthcare department [17]. Moreover, the work that is to be done in future may incorporate the assimilation of the vehicle routing problem in the supply chain management during emergency situations. A dramatic shift is identified in the study in the value chain and there is an upstream moving flow from surgery and recovery towards monitoring and prevention [13].

Denicolai, Previtali and change [13], also show that there is a dramatic shift in the value chain that is moving upstream from the surgery and recovery to prevent and monitor. Another important aspect highlighted by Denicolai, Previtali and change [13], such as optimization and prediction in healthcare supply chain management. There are certain risks associated with healthcare service such as supplier opportunism, irregularity of the information as well as unclear goals, such risks might be exaggerated based on the dynamics of the technical connections and the relationships and such risks are resulted as the consequence of the weak control of the purchaser as well as limited grip into the service procedures and the delivery [15]. However, there is a lack of knowledge and understanding regarding the extent and direction of these aspects and dynamics, as well as their impacts on how the value chains preparedness and organizational capacities are managed.

In the field of health care, the agile supply chain implies flexibility in providing service to the patients without a limitation of fixed numbers of patients to be attended per day, reducing the processes to be followed by patients in acquiring services by integrating and coordinating properly the processes, quick response to the patient, avoiding long waiting times of services by offering prompt delivery of the service to the patient [27, 28].

Many studies in the field have been conducted to determine the quality of service in healthcare; however, researchers have not reached a consensus on the critical factors that are sufficiently rigorous to link and measure the healthcare service quality based on the supply chain preparedness. Considering ongoing uncertainties, healthcare organizations should be reprogrammed and reposition themselves [29]. It is necessary to conduct more empirical assessments to be able to replicate results in different contexts [30]. Al-Saa'da, Taleb, Al Abdallat, Al-Mahasneh, Nimer and Al-Weshah [31] Investigated the impact of supply chain management and preparedness on healthcare service quality and made several recommendations. To enhance the quality of healthcare services, hospitals must prioritize supply chain activities, which requires a transformation of ways of thinking in addition to practices.

Simwita [32], argued that agile supply chain applicability in healthcare organizations contributes to smoothening the operations by enhancing quality of service; this is achieved by introducing flexibility in healthcare processes, reducing time spent of patients in hospital, and enhancing the healthcare delivery system. Many studies have found that lean and agile strategies represent means for enhancing healthcare processes [33-35].

The healthcare sector is very important for every nation. Numerous countries heavily regulate this sector owing to the unique nature of supply and demand in this sector. Considering characteristics of the competition in the medicines and materials markets, governments are expected to balance economic and clinical interests. Accordingly, supply chain managers should implement agility in supply chains to respond to the speed of change and the growing competition in markets.

4. CONCLUSION AND RECOMMENDATIONS

With the increasingly advancing technology and digitization, the healthcare systems have also become digitised and online. The operations and development of the healthcare services have undergone a transformative change, which is still underway towards more advancement in the digitised and online medium with the constant technological growth. Healthcare services and management systems have adopted the digital medium through various mobile healthcare devices and applications, wearable devices for fitness and health, e-prescription, fitness and healthcare applications, and others. This, added with the current situation of global pandemic, has led to various disruptive and transformative changes in the healthcare procurement and supply chain systems. Healthcare sector has been undergoing a shift towards supply chain management of its products and services as well as management of its operations and supply chain. Also, governments should enforce laws and regulations that protect and sustain the supply chains for medication, medical consumables, and non-medical consumables.

The study of the selected articles highlights some of the key aspects related to supply chain management processes in healthcare sector. Especially during the current critical times of global pandemic and social distancing, this study shows several new perspectives for the design and criteria of supply chain management systems. One of the most important aspect highlighted is that technology and departments of IT have a dominant role and position in the processes of supply in the rapidly advancing times. It further highlights how certain crucial aspects of supply chain management and operations remain neglected and are not paid much attention to. Another aspect of importance directed in the study is that a balanced and vital level of attention must be given to both internal as well as external factors of supply chain management. The study shows that there are several factors that are required for successful implementation of supply chain management, like supplier education and awareness, readiness of implementation of the framework, as well as adequate availability of resources and IT infrastructure. These are the crucial aspects to be considered by the healthcare sector to be able to attain successful shift in the supply chain processes. Additionally, both the positive as well as negative impacts of the shift in the processes must be well-assessed beforehand to address them accordingly. This also means that both long-term as well as short-term impacts must be assessed and evaluated for making the required changes and improvements. Strategies and optimization techniques must be developed and implemented for addressing the existing gaps in the processes and develop healthcare operations accordingly. Moreover, the supply chain performance of the organization is a vital instrument that determines the overall organizational efficiency. Although limited by the fact that, a complete review of literature cannot be attained, this study sheds light on existing research on healthcare supply chain management, and exhibits potential areas where further evaluation research would be useful. Furthermore, these findings demonstrate the need to build a theory-based model, which includes the main factors that are required for successful implementation of supply chain management in the healthcare sector.

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