THE IMPACT OF SUPPLY CHAIN UNCERTAINTY AND PROCUREMENT OPERATIONS ON HEALTH CARE DELIVERY IN PAKISTAN

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Abstract

The research paper aims to investigated the impact supply chain uncertainty and procurement operations on healthcare delivery in healthcare sector of Pakistan. It sought to confirm the existence of uncertainty involved in supply chain management and its possible effect on stock outs of drugs and other medical supplies. Both qualitative and quantitative data is collected. For qualitative data, literature from different secondary sources is reviewed and analyzed, similarly, for quantitative data collection, convenience Sampling was used and overall employees and healthcare service providers working in different hospitals were targeted for data collection. Based on the data gathered from a set of closed ended questionnaire the study resulted in several findings that suggested the actual impact of supply chain uncertainty and procurement operations on quality of care and the complexities and constraints related to hospital supply chain management along with its effect on healthcare delivery, and the hypothetical assumption of this research is accepted whereas the null hypothesis is rejected.

Keywords: supply chain management; healthcare delivery; procurement; healthcare supply chain management; supply chain uncertainties.

Introduction

In overall world, the concept of supply chain management has been growing rapidly and acted as a driving force for all industries to flourish. Manufacturing Industry, Retail industry and E-commerce industry have observed a notable growth due to the high consumerism and on time availability of products. With the increasing demand as well as competition among the different industries, organizations are now thinking more efficient ways to keep their customers intact by emphasizing towards an implementation of efficient supply chain management practices.

The implementation for an integrated supply chain has become important for many organizations over the concerns of increasing competition, knowledge and customer satisfaction (Fantazy et al., 2010). But the idea for health care supply chain management is still very new due to the complexities involved in it and with the lack of relevant studies to fill in this gap uncertainties of supply chain effect on procurement operations and health care delivery is still debatable.

Supply chain management in the healthcare sector is as important as the supply chain management in any other industry but the importance is huge due to the human factor associated with it. (Abdulsalam et al., 2015). Hospital in particular provide services to the patient and on time availability of medicines as well as healthcare equipment plays a critical role in quality of healthcare delivery.

Procurement function has a major role in effective supply chain management. Sourcing, ordering and delivering the medical supplies where needed has to be effectively managed (Lingg et al., 2016), but in times where demand and supply continuously fluctuates the procurement operations also faces major issues and constraints and with such issues the quality of healthcare delivery becomes questionable.

There are different researches that includes several aspects of healthcare supply chain management, its effective and efficient implementation along with the challenges in doing so and the association these healthcare supply chain management towards the hospital performance and quality care can also be shown in past researches but still the health industry has not much able to absorb these practices and derive benefits from it (Rakovska & Stratieva, 2017).

The past year have also changed the overall dynamics of healthcare delivery and supply chain management due to pandemic outbreak and uncertainties involved in supply chain management.

Pharmaceutical products, ventilators, PPE kit and oxygen cylinder being short from the market created much trouble for the healthcare providers in managing the healthcare delivery, and the fluctuating supply and demand raised many troubles towards the efficient healthcare delivery (Armstrong, 2020). For this purpose, the aim of this study is to analyze the impact of supply chain uncertainty and the issues and constraint involved in it has on procurement operations and the quality of healthcare delivery in different public private hospitals of Pakistan.

Literature Review

Health care supply chain management

The supply chain management involves an integrated flow of information and include all activities from sourcing raw material to delivering goods or services that creates value to final consumers. Whereas, Healthcare supply chain management involves obtaining resources, managing material flow, and delivering goods to service providers in order to provide optimal services to patients within the right time as the ultimate costumer (Lee et al., 2011)

The main objective of hospital supply chain is therefore to satisfy the requirements as well as needs of all stakeholders with value products in right quantities and at right time. The Stakeholders involved in a hospital supply chain are categorized in different groups by a researcher (Buttigieg et al., 2020), these stakeholders can be classified as, suppliers of medicines and surgical supplies and equipment, buyers, healthcare providers, patients, government organizations and regulatory agencies.

Supply chain being evident in every sector also has a great importance and is now considered to be the backbone of health care industry (Mathur et al., 2018). Supply chain in hospital sectors involves flow of products, machinery, medical supplies, equipment along with the participation of different stakeholders, and its main focus is to deliver all such products and resources in a specific time frame and in order to fulfill the needs of both patients and healthcare service providers (Pinna et al., 2015)

Hospital supply chains require and efficient flow of resources just to satisfy patient needs along with the need of service providers (Schneller et al., 2011). Undeniably, patient

logistics, data and material flow and integrated functions of supply chain is important for efficient and quality healthcare delivery (Vries & Huijsman, 2011), an integrated supply chain management not only influences the performance of hospital but also enhances the quality of hospital supply chain and healthcare delivery.

The primary functions of health care supply chain management are not so different but it revolves around a main objective that is to save lives and the quality of health care delivery totally emphasizes upon the availability of pharmaceutical supplies in right quantity and at right time (Mathur et al., 2018).

Similarly, the maintenance of machinery as well as health care equipment also requires efficient materials management and supply chain plays an important role in doing so. According to an article (Vries & Huijsman, 2011) with the passage of time healthcare industry has also changed its dynamics due the increased competition, knowledge and awareness, increasing impact of patient-associations has built and urge to deliver health services in a more efficient and effective manner.

Procurement Operations and Healthcare delivery

Services cannot be procured for storage like physical goods, similarly long lead times cannot be affordable in healthcare system being patient life involved (Meijboom et al., 2011), Thus supply chain supports healthcare delivery (WHO, 2011) and involves procurement functions that manages demand, select suppliers to fulfil those demand and requirement, manages relationship and effective delivery of healthcare supplies and resources (Weele, 2014).

On time availability of drugs, medical supplies are an important factor due to the unacceptability of long waiting time due to the product shortage which can worsen a patient condition at times or in extreme case can result in loss of lives (Mustaffa and Potter, 2009).

This therefore contributes towards the importance of supply chain management and specifically procurement operation that must ensure the availability of pharmaceutical supplies as well as medical equipment (Meijboom et al., 2011). Different researches suggest that inefficiency of procurement process and excessive lead times causes stock out of pharmaceutical supplies and medical equipment that affects effectiveness and efficiency of healthcare delivery (Kumar et al., 2008).

The importance Healthcare supply chain management is further emphasized by several researchers, and it’s been noted that within the hospital sector; procurement functions along

with medical supplies and equipment can affect healthcare delivery and patient care (Mustaffa and Potter 2009), Similarly,

Supply Chain Uncertainty in Healthcare

Supply chain management has been successfully implemented in many industries but the healthcare sector has not seen much improvement with healthcare supply chain practices which is complex as compare to any other industry as it directly deals with patient care and human life. (Mathur et al., 2018).

Due to its complex nature, hospital supply chain has various uncertainties involved in it and is often portrayed as disorganized and inefficient supply chain (Abdulsalam et al., 2015) Supplier uncertainty, demand and supply fluctuation and environmental factors involved in supply chain management causes disruption in healthcare services and affect the overall efficiency of supply chain management.

Supplier Uncertainty

Uncertainty often increases the risk to an efficient procurement and leads to severe consequences that can affect the efficiency and effectiveness of overall supply chain. In any industry suppliers plays an important role towards procurement functions; reliable and responsive suppliers can reduce disruption in supply chain and with specific and reliable suppliers, uncertainty can be eliminated among the supply chain.

Similarly, in health sector, selecting an appropriate supplier is vital as the overall purpose of supplier selection is to have quality suppliers that can deliver best products or services at the time of need (Gurgur, 2013).

In healthcare supply chain, another major decision while selecting or evaluating a supplier is whether to have single source suppliers or buy from multiple sources. For single sourcing, literature shows that it can be a major risk that will lead to supply chain failure and can worsen hospital supply chain which will adversely affect healthcare delivery and ultimately results in loss of precious lives (Khan & Burnes, 2007). Whereas, having multiple source supplier make certain that if there is an unavailability of a single provider than we can also shift towards another provider with ease. Thus, avoiding major mishaps and possible stockout of medical supplies and equipment (Elijah et.al., 2013).

Accordingly, the main concern over decision making regarding the selection of supplier is to have the best provider in terms of on time delivery with reduced lead time, and has a string relationship making skills and is smart with financial sense which will overall streamline the whole procurement process.

Demand and Supply Uncertainty

Pharmaceutical supplies are considered to be a major part of healthcare delivery and is required by all healthcare providers to satisfy the patient needs and give quality care to them. Similarly, other medical supplies and hospital equipment are equally important considering the fact that they influence healthcare performance and delivery and are observed as risky of shortages and possible stockout (Lingg et al., 2016).

Considering the demand and supply uncertainty there many researches that regards the main cause of its occurrence is whether a seasonal demand or disease outbreak that could possibly impact healthcare supply chain management and disrupts the whole procurement operations (Ivanov, 2019). According to researcher the effect of such uncertainty has a disastrous effect on hospital supply chain and can ultimately collapse the overall healthcare delivery (Queiroz et al., 2020).

With demand uncertainty it is always difficult to analyze the right quantity of materials or requirements in order to achieve the accurate sales. Such uncertain demand may either lead to excess stock or no stock situation. In case of pandemic or disease outbreak, there are doubts involved with the size of demand for healthcare services and due to increasing number of patients such situation always led to an operational blockage (Song et al., 2018).

Unpredictability in demand and supply directly impacts on inadequate resources of healthcare sector that includes limited capacity and equipment, insufficient materials, hospital supplies and medications and this deficiency ultimately compromises healthcare services, quality and deteriorates the overall procurement operations.

Supply Chain Uncertainty due to Socio-political and Environmental factor

Supply chain and procurement operations also suffers dur to different environmental factor such as occurrence of a natural disaster or a pandemic outbreak but this is also leading to demand fluctuation. However, in case of political instability caused due to different social factors the healthcare management specifically patient care and pharmaceuticals industry faces many issues.

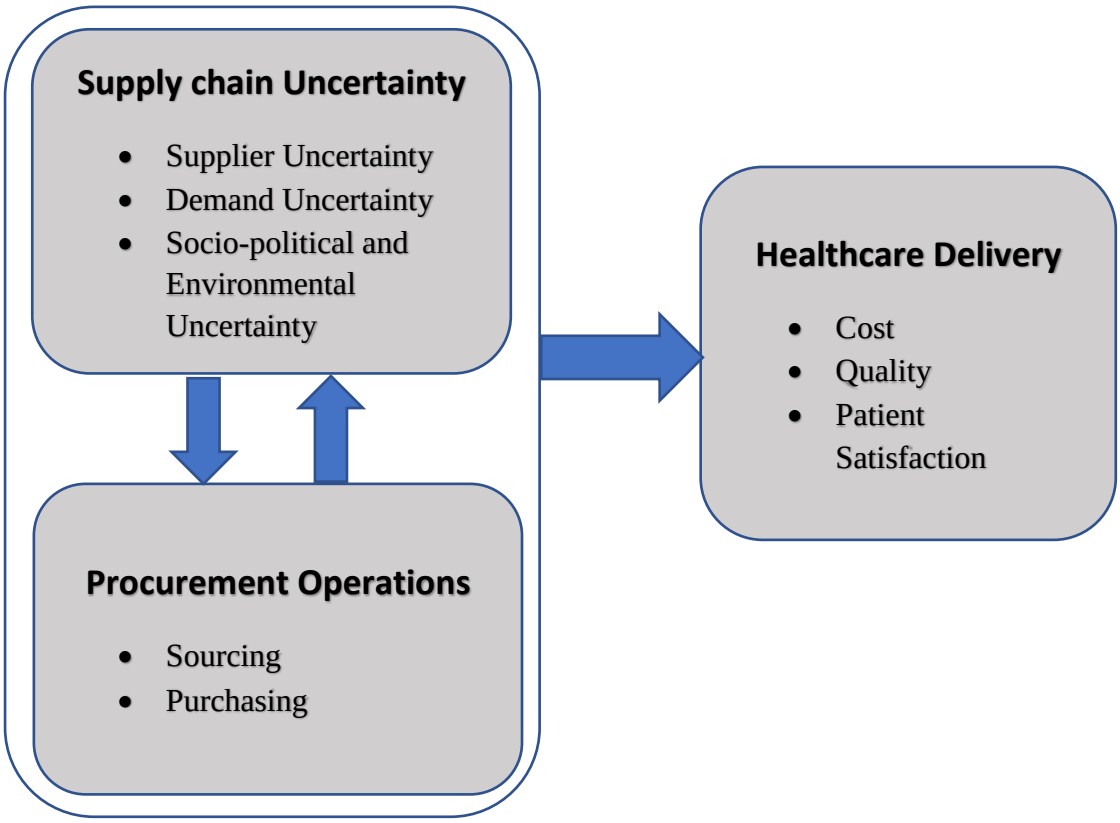
Environmental uncertainty refers to the unexpected or unanticipated occurrence of change externally on which none has a control over, such change that may create instability in overall business or industry (Jangga et al., 2015). Whereas political instability or socio-political uncertainty refers to the occurrence of any foreseen variation due to the border tension or political influence. when a sudden outbreak or disaster occurs, healthcare facilities has to deal with unbearable demands and along with the uncertain environment and of socio-political situation such disasters has an unanticipated impact on hospital operations that directly affects the supply capacity, utilisation, and patient demand (Joseph J. Cavallo, 2020).

Ban of import due to the political tension between border countries is a common issue, and during past few years due to such situation pharmaceutical industry have faced shortages and decline in their sales (Ilancheran, 2020), pandemic outbreak during the past years has also increased demand for active pharmaceutical ingredients and drugs but due to the lockdown situation that occurred world wide and impose ban on imports created shortage for these medical supplies in overall world and in Pakistan. The ultimate effect due to these shortages were on healthcare delivery.

Conceptual Framework

A tentative statement is developed based on the above reviewed literature that revolves around the possible impact of supply chain uncertainty and procurement operations on the healthcare delivery in hospitals.

The below figure 1 shows the graphical representation of the overall conceptual model of this research study.



With the gaps identified in the previous studies it can be assumed that, there is a significant impact of demand uncertainty and supplier side uncertainty on health care service delivery in terms of quality, cost and patient satisfaction. It can also be assumed that with such demand uncertainty it creates a bottles neck for procurement operations and created hurdles for sourcing and purchasing of healthcare associated materials and resources.

Another possible assumption related to the study can be that the socio-political instability or environmental factors also causes supply chain uncertainty which also has a significant impact on procurement operation and effect the healthcare delivery.

Research Methodology

The research held with respect to this thesis was a descriptive research. In order to meet the objectives of this research study, both qualitative and quantitative survey was conducted, a semi-structured questionnaire survey was distributed among the focused staff to investigate the importance of efficient supply chain management and the impact of uncertainties and procurement operations on health care delivery.

According to (Ali Khan, 2019) there are total 1,979 public and private hospitals and 132,227 available patient beds in Pakistan. There are 441,036 healthcare workers that include doctors,

nurses, pharmacist, midwives, bio-medical engineers (Abdullah et., 2014). This total number is considered as the main population of this study and both public and private hospitals of Pakistan were targeted for the research purpose.

From the overall population of healthcare service providers, a sample size of 347 is selected as a respondent of this study. This sample is calculated based on Raosoft sample selection criteria and according to which a sample size of 347 would have around 5.22% of error margin and will be with a confidence level of 93.94.

The sampling technique used in this research is non-probability sampling; i.e.; convivence sampling. This technique was used due to the large number of populations and online questionnaire was sent to different health sectors employee to gather responses. A close ended questionnaire based on 5 points Likert scale was distributed among the healthcare service providers, biomedical engineers, doctors, nurses and employees of material management department. Other than this, extensive literature was reviewed in order to investigate the impact of uncertainties in procurement functions and the past year pandemic situation effect on health care delivery.

For an improved validity of the research instrument the questionnaire was sent to the director supply chain of a reputed hospital and his valuable feedback was incorporated for the correction and improvement of this research instrument. Further-more to check the reliability of the questionnaire made by the researcher, the questionnaire is tested through pilot study. After which the reliability of the questionnaire is measured by Cronbach alpha's range. For a good reliability the range should be between 0.7 – 1, only then the questionnaire is considered as reliable but if the range is below 0.7 then the questionnaire is not considered as reliable.

Ethical Consideration

Considering the ethical aspect of the research the name of the respondents and the name of the hospitals are kept secret. Sufficient period of time was provided to the respondents of the research so that they could fill the research queries to the best of their knowledge and understandings. Consent was acquired from the respondents and their approval was ensured for the use of their given data. Discretion, privacy, secrecy and anonymity of the respondents and their responses were strictly maintained to guarantee confidentiality of their data

Results and Discussion

Demographic Profile:

The demographics data included gender, age, occupation and monthly income. Out of 347 respondents, 180 were female and 162 were male. The majority of the respondents were employed (228) in health care sector. The age of the respondents were mainly lying between 30 to 49 years (241) while least in age of 50+ having frequency of 7. The highest range of the monthly income falls between Rs.50, 000 to 100,000 (159) followed by Rs.100, 001 to 150,000 (96).

Fig 4.1. Demographic Profile

		Frequency	Percent	Valid Percent	Cumulative Percent
Gender	**Male**	162	47.6	47.6	47.6
	Female	180	52.4	52.4	100
	Total	**342**	**100**	**100**	
Age	**Under 19**	11	3.2	3.2	3.2
	20-29	83	23.9	23.9	27.1
	30-39	125	36.6	36.6	63.7
	40-49	116	34.3	34.3	98
	50+	7	2	2	100
	Total	**342**	**100**	**100**	
Monthly Salary	**<50,000**	85	24.8	24.8	24.8
	50,000-100,000	159	46.7	46.7	71.5
	100,001-150,000	96	28	28	99.4
	150,000>	2	0.6	0.6	100
	Total	**342**	**100**	**100**	
Occupation	**Doctor**	10	2.9	2.9	2.9
	Nurse	48	14.1	14.1	17
	Bio-Medical Engineer	56	16.4	16.4	33.4
	Procurement Staff	228	66.6	66.4	100
	Total	**342**	**100**	**100**	

Descriptive Statistics

Fig 4.2. Descriptive Statistics

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Supply Chain Uncertainty	342	3.7560	.67566	-.626	.131	.269	.261
Procurement Operations	342	3.4313	.79579	-.381	.131	.065	.261
Health Care Delivery	342	3.4157	.74463	-.182	.131	-.337	.261
Valid N (listwise)	342						

Above mentioned table shows that the maximum skewness belongs to variable of delivery quality i.e. -.172(Mean=3.355, S.D =.753) and the minimum skewness belongs to variable of Supply Chain Uncertainty i.e. -.626 (Mean=3.75, S.D =.675).

Reliability

Fig 4.3. Reliability

Constructs	**Cronbach's Alpha**	**Number of Item**
Supply Chain Uncertainty	0.721	5
Procurement Operations	0.573	4
Health Care Delivery	0.626	4
Overall	**0.849**	**13**

The above-mentioned table is reliability of all constructs used in this study. According to Hinton, Brownlow, McMurray, and Cozens (2004), Cronbach's alpha value above 0.75 is considered as high reliability while 0.5 to 0.75 signifies moderate reliability. The overall

reliability of the complete instrument used in this study is 0.849. The highest reliability is of Supply Chain Uncertainty (0.721) and the lowest is of Procurement Operations (0.573).

Inferential Analysis

Supply Chain Uncertainty

Fig 4.4.1. MODEL SUMMARY

Model	R	R Square	Adjusted R Square
1	.537 [a]	.289	.287

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	65.905	1	65.905	139.983	.000[b]
	Residual	162.429	345	.471		
	Total	228.334	346			

a. Dependent Variable: PI

b. Predictors: (Constant), CN

Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	960	208		.608	000
CN	646	055	537	1.831	000

a. Dependent Variable: PI

The Regression analysis results from the above model signifies that the predictor supply chain uncertainty has an association with health care delivery and explain 29% of the variance (.289, f=139.983, p<.05), which according to Cohen (1988) is a slightly moderate effect large effect.

Procurement Operations

Fig 4.4.2. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.520[a]	.270	.268	.69510

ANOVA[a]

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	61.641	1	61.641	127.576	.000[b]
Residual	166.693	345	.483		
Total	228.334	346			

a. Dependent Variable: HD

b. Predictors: (Constant), PO

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.450	.175		8.266	.000
FN	.567	.050	.520	11.295	.000

a. Dependent Variable: PI

The Regression analysis results from the above model signifies that the predictor procurement operations have an association with Health Care Delivery and explain 27% of the variance (.270, f=127.576, p<.05), which according to Cohen (1988) is a slightly moderate effect large effect.

Hypotheses, Assessment and Summary

Fig 4.5. Hypotheses, Assessment and Summary

S.no	Hypotheses	Retain /Rejected
H1	There is no significant effect of supply chain uncertainty on health care delivery	Rejected
H2	There is no significant effect of procurement operations on health care delivery	Rejected

Conclusion

The result suggests a significant relationship between supply chain uncertainty and procurement operations on health care delivery. The same evidence is provided by Bvuchete et al., (2020) in his research. According to him healthcare supply chains ensure supply chains in health care are experiencing significant challenges with the management and distribution of the at the right time and at the right cost. This has led to poor health care delivery services outcomes. In addition, the public health supply chains also face major challenges due to increasing patient expectations and inefficiencies in the supply chain operations.

Moreover, Pettersen et al., (2020), suggest that a hospital delivery system involves a complex and longitudinal public procurement process where pre-hospital services are transformed from relational and outsourced governance to more formal arrangements based on legal and transactional controls. This procurement process is facing significant challenges including public scrutiny, legal actions and administrative staff resignations. The public body lacked procurement competencies and the learning process.

Recommendations

Healthcare sector specifically hospital supply chain management should have operational efficiency due to the complexities involved in the nature of service they are providing. Healthcare quality and patient satisfaction is always associated with the capacity and resources utilization. In case of stockout or non-availability of drugs or resources both patient care and satisfaction would be compromised. It is a known fact that not all things can be

controlled but known risk or anticipated certainties can be dealt with effective managerial skill and possible solutions.

Supplier side uncertainty can be controlled or minimized by sourcing materials or resources from multiple suppliers and building strong relationship with many quality suppliers. Relying on a single source in a hospital environment is quite risky.

Similarly, for demand fluctuation or uncertain political instability it is suggested to introduce and implement the concept of vertically integrated supply chain management in hospital. With vertical integration the issues related to sourcing or limited stock can be minimized. However more research work is required for its effective implementation.

Overall, it can be said that the concept of supply chain management in health care sector is still very new and the effective implementation still requires extensive research. There are many concepts related to the supply management that can be introduced in healthcare industry to enhance the quality of care provided to patients and will also increase patient satisfaction.

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