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Managing critical supply chain *issues* in Indian healthcare

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Abstract

This exploratory study proposes a new approach that utilized pre-built issues libraries in healthcare supply chain. Supply chain related issues are collected and deduced from the literature to build issues libraries. This is followed by application of group decision-making for their prioritization and defining solution requirements from doctors' perspectives. A new approach of shared decision-making is proposed by utilizing literature for developing pre-built issues libraries as an input to shared decision-making. Quick identification and resolution mean that an organisation is continually learning and moving towards excellence. It can be used as a checklist for comparison within and across organisations. Usage of open source applications such as Google Sheets and WhatsApp was utilized for geographically dispersed experts.

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Keywords: Supply chain, healthcare, hospital, issues, issue-based decision-making, India.

1. Introduction

Healthcare systems and processes play a critical role in supporting the healthcare needs of any society. In the functioning of hospitals, it is usually observed that some resources get wasted and delays occur at different levels and at different times due to patients seeing multiple-providers spread across multiple-locations. Developed countries have a different set of health concerns, in this study termed as *issues,* when compared to the developing countries. Foremost *issues* in the developed markets are ageing populations and increasing incidence of chronic diseases whereas for the developing countries it is the management of greater incidence of chronic diseases with the lack of apt infrastructure say at hospitals, clinics, and healthcare [1]. Healthcare providers and healthcare seekers have to manage uncertainty that could be due to factors including changes in lifestyles, demographics, expectations, technology and new facilities [2]. In order to eliminate waste, minimize delays and create value for patient, there is a need to look into the full cycle of care [3]. This study researches

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the supply chain *issues* as applicable to Indian Hospitals and suggests an approach towards their resolution as well as contribution to the Value Agenda.

Literature Review

2.1 Value and supply chain management in Healthcare

Value in healthcare has been defined [4, 5] as "health outcomes achieved per dollar spent". The goal of healthcare delivery should focus on providing high value to patients around which all actors in the system should be united. When measuring value for primary care and preventive care, the emphasis should be on the definition of patient groups having similar needs [5]. Again, when measuring value there should be consideration of all services and activities that together achieve success when meeting the needs of patients [5].

In literature, supply chain management has been studied from different perspectives by different authors. Here, we are aiming from the perspectives of the healthcare providers with focus on doctors. The definition of supply chain management here is based as "information, supplies and finances involved with the acquisition and movement of goods and services from the supplier to the end user in order to enhance clinical outcomes while controlling costs" [6].

2.2 *Issues Identification in Hospital Supply chain*

Oxford dictionary defined an 'issues' as both noun and verb. The defined meanings are many but for the purpose of this investigation the meanings at Table 1 are being considered:

Table 1: The meaning of issues as both noun and verb

Connotation	Noun	Verb
1	An important topic or problem for debate or discussion	Result or be derived from
2	The action of flowing or coming out	Come, go, or flow out from
3	A result or outcome of something	Formally send out or make known
4	Personal problems or difficulties	
5	Problems or difficulties, especially with a service or facility	

In an analysis carried out on the operations and supply chain management in healthcare for period 1982-2011 [7], the leading topics of study include service operations strategies and objectives and planning, scheduling, and control of services, the five topics that emerged to be most prevalent were information technology and new technology in services, general aspects of strategy and objectives of operations in services, selection and design of the service delivery system, strategic quality issues in services, and lastly capacity planning, scheduling, and control. These issues can be looked up or deduced directly for research papers and they can also be ascertained through focused discussions on the opportunities and/or mention of certain ideas that lead to certain effects. While going through an improvement case study of a hospital [8], a few of the issues were identified from the text as different employees working in the same role performs the same tasks in different ways, employees have superficial understanding of their work requirements, lack of knowledge and understanding regarding how their work affects the requirements of quality outcomes, lack of understanding regarding what constitutes satisfactory performance, lack of accountability, lack of shared understanding, blind adherence to the inherited processes, processes inherited orally and not through institutional processes etc.

There are also a number of other issues and frequently observed in healthcare supply chains [9] such as correctly forecasting patient arrival frequency, accurately envisaging duration of visit, calculating product requirements, and lack of education in supply chain management [10].

2.3 Data Standards

Any supply chain needs quality and timely data for its efficient and effective working and could be sourced from web and social media data, machine to machine data, transaction data, biometric data, human generated data [11]. A few of the issues that are generally faced while using the health care data is the fragmented data and generation in legacy IT systems with incompatible formats [12] and lack of standardization [13]. The GS1 system and the Health Industry Business Communication Council system are two data standards established on supply chain in healthcare; however yet not fully implemented in the Indian healthcare system.

2.4 Developing and maintaining solutions

Even when opportunities are to be explored for betterment, there is a need to identify issues whose resolution leads to betterment. Hospitals today have many tools and techniques available to them and that could be combined with approaches such as, lean six sigma [14], and business process reengineering [15] and theory of constraints [16] available to them for developing solutions.

When providing patient care, there is sharing of different types of resources which incur costs and to be measured based upon their actual use during care and not as their averaging [5]. These resources could be in the form of space, equipment, people or supplies [17]. In the process of developing solutions, the healthcare providers can benefit through collaboration with other providers through benchmarking studies [18].

2.5 Digital Divide and Analytics Divide

Digital divide has both policy and managerial implications [19] and a need for making policies to close the gap between the haves and the have-nots. In any health care situations where there is some level of deployment of information and communication technology infrastructure in health systems, it is not the just digital divide but the analytics divide among the providers that impact their reach, efficiency and effectiveness. In a joint study of more than 4500 managers and executives from more than 120 countries, it was seen that there is a growing divide between companies who value and use business analytics and those that are yet to embrace them. Three competences that transformed organizations were identified as i) information management; ii) analytics skills and tools; and iii) data oriented culture [20].

2.6 Linking Issues and Effects

The Table 2 shows a sample list of *issues* and their effects as combed through the literature to be used as a reference for discussion, validation and updating/refinement. Here *issue* to Effect1 to Effect2 are only shown. In reality the effects could be expanded to go to Effect3, Effect4, Effect5, etc.

Table 2: Sample list of issues and their effects (to Effect1 to Effect2)

Issue	Effect1	Effect2	Author
Lack of common understanding across departments	Communication and coordination of activities	Delays in service provision	[10]
Leadership	Effective teamwork		[18]
Atmosphere of trust	Effective teamwork		18]
Lack of education in SCM			[11]
Lack of standardisation of data			[8]
Barriers to accessing data of desired	Adoption of data standards	Moving towards excellence in the	[25]

quality and quantity		supply chain	

2.7 The Analytic Hierarchy Process (AHP)

The Analytic Hierarchy Process (AHP) [21] is an established method for prioritisation in Multi-Criteria Decision-making (MCDM) problems which subjects any defined decision problem into criteria and alternatives and subjects it to a series of pair wise comparisons before synthesizing the results. In AHP [22], the hierarchy consists of several levels and wherein the top most level is taken as the goal/objective as per the problem statement. The lowest level of the hierarchy contains the alternatives that are to be assessed on the criteria that have been decided. The values on a nine point Saaty scale are required to be assigned for making paired comparisons and are equal - value 1 , moderate - value 3, strong - value 5, very strong - value 7, extreme - value 9 and the values 2, 4, 6 and 8 as the intermediate values. The result of the pairwise comparisons could be inconsistent. During the analysis of an $n \times n$ judgment matrix using the AHP, we are also to check the consistency of judgments through the use of a consistency index (CI) as given in equation (1)

$$CI = \frac{\lambda_{\max} - n}{n-1} \tag{1}$$

where $\lambda_{\max}$ is the largest eigenvalue of the judgment matrix .

We also calculate the consistency ration (CR) given as in equation (2)

$$CR = CI / RI \tag{2}$$

where RI is known as the random consistency index and whose values depend upon the matrix . We accept the inconsistency if $CR \leq 0.1$; else there is a need for revising the judgments..

Methodology

For achieving the desired outcomes, we propose using an Issue Based Decision-making (IBDM) model. This proposed **BOIDPAM** methodology (Figure 1) for identifying specific *issues* and specific solutions requirements includes - Build (B), Order (O), Identify (I), Define (D), Prioritise (P), Act (A) and Maintain (M) modules and each is described as follows:

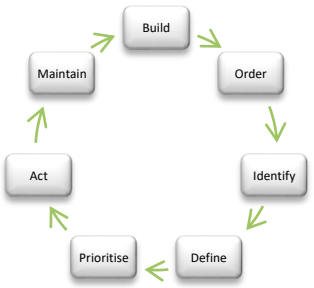

Figure 1: BOIDPAM seven steps (Authors View)

1.1. Step 1: Building the issues library (B)

Building the *issues* library is the first step in our methodology and in this research was carried out by

deducing the issues from the widespread literature covering supply chain, healthcare and hospitals. This is an evolving list and may get updated in the Step 2 of this method.

1.2. Step 2: Order on Criticality (O)

The *issues* library was then shared in advance with ten participating doctors spread across different hospitals and working in different departments for the prioritisation of *issues* as high, medium and low. The *issues* library was uploaded from MS Excel file into the Google Sheets application and shared using email and WhatsApp group with the participating doctors. Table 3 below shows a sample list containing the issues that were classified under High Critical categories. The *issues* that were classified as High through consensus by the participating doctors were taken up for further study.

Table 3: Issues Library classified under High critical categories

Issue Code	Criticality (High/ Medium/Low)	Issue
SC001	H	Lack of common understanding across departments
SC003	H	Delays in service provision
SC014	H	Required information not available for learning and making improvements.
SC016	H	Adoption of data standards

1.3. Step 3: Identifying the root issues (I)

Issues as identified in the High-Critical list were mapped in Issue-Effect linkages through a group workshop in one hospital. The Issue-Effects table (Table 4) links *Issues* and Effects and made by working on the *issue* library and placing *issues* under appropriate category.

Table 4: Linkages - Issues and Effects from the Issue-Library

Issue	Effect 1	Effect2	Effect3
Lack of strong managers	Lack of change in SC		
Inconsistency in applying performance metrics	Difficult to make changes across SC	Difficult to assess the impact of change	
Lack of education in SC	Lack of capability in managing SC	Absence of SC performance indicators	Difficult to change employee behaviour
Lack of enterprise wide integration	In consistency in applying performance metrics	Difficult to make changes across the SC	Difficult to assess the impact of change

The issues in the Issue-Effects table are then converted into the Effect-Whys diagram by placing the right most effect in the table at the bottom of the diagram. The Whys which are seen to progress from the bottom listed Effects and upwards are the lower level effects. In the Effect-Why diagram, we find ‘Lack of enterprise wide integration’ as one of the root issues and arrive at the 3 Why level.

In Figure 3, the root issues that were identified after the workshop included 1) No supply chain leadership at executive level; 2) Lack of education in supply chain; 3) Lack of enterprise wide integration; 4) Lack of data standards; 5) No shared understanding of costs; and 6) Lack of interdepartmental process integration.

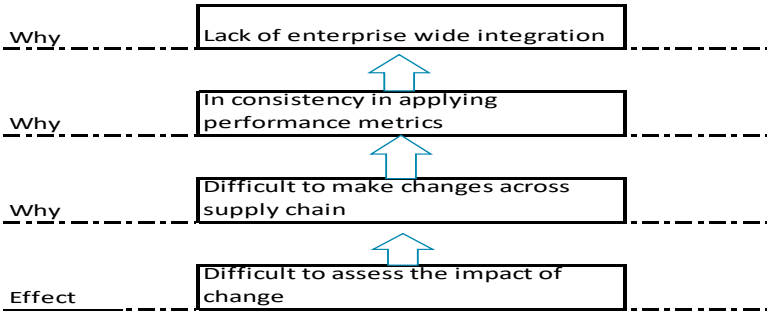

Figure 2: Effect-Why-diagram (Authors View)

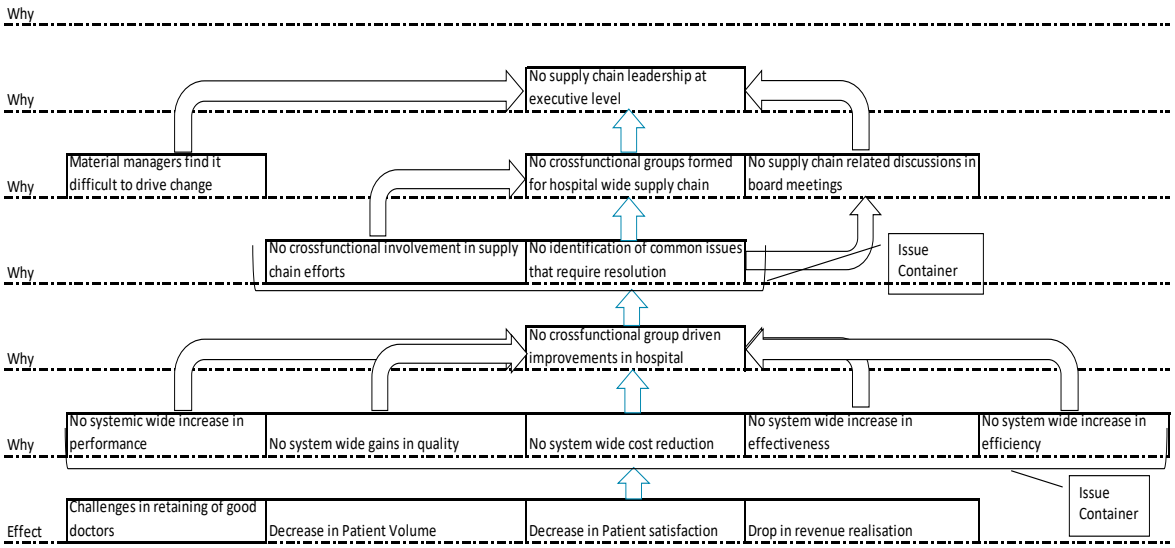

Figure 3: Root Issues diagram (Authors View)

1.4. Step 4: Defining solution requirements (D)

The root *issues* are converted to solution requirements by making them into solution requirement as at Table 5.

Table 5: Root Issues and Solution Requirements

Root Issue	Solution requirement
No supply chain leadership at executive level	Hire a supply chain leader at executive level
Lack of education in supply chain	Trainings to be provided on supply chain
Lack of enterprise wide integration	Enterprise wide management of supply chain
Lack of data standards	Implementing GS1 Data Standards
No shared understanding of costs	Develop comprehensive cost measurement system
Lack of interdepartmental process integrations	Develop processes for providing integrated care

1.5. Step 5: Prioritizing the solution requirements (P)

In this study, we are applying the paired comparison method [21], the preferred [22] form to generate relative priorities for implementation of the solution requirements. The values obtained through the pairwise comparisons show a Consistency Ratio of 0.106 and Consistency Index of 0.141. As the CR is very close to the acceptable value, we can say that judgements are acceptable. Based on the pairwise comparison, the priorities list of solution requirements includes 1) Develop processes for providing integrated care; 2) Hire a supply chain leader at executive level; 3) Trainings to be provided on supply chain; 4) Enterprise wide management of supply chain; 5) Develop comprehensive cost measurement system and 6) Implementing GS1 Data Standards.

1.6. Step 6: Taking ACTION for the solutions (A)

Once the hospital has decided on what solutions are needed to be implemented, it could start implementing them. The diffusion, maintenance and sustenance of standardized practices in a value creation system across a health care organization require a disciplined approach to their management and measurement [3]. Thus any action towards a solution or better state requires following a discipline approach. Once the areas requiring solutions are prioritized, the organization could explore approaches that it feels could be adopted based upon its unique situation and considering factors such as resource availability, time, cost, etc. [23].

1.7. Step 7: MAINTAIN the new state (M)

When changes are not institutionalized and followed in a routine, there exist the possibilities of reverting to the earlier state of decision-making. Sometimes, both the new and old ways of doing work coexist which lead to confusion with potential of mistakes. Dashboards, driven by data could be used for integrating strategic and operational decision-making [24].

Results

Following the seven step procedure and with the example in our situation and the value of Consistency Ratio obtained from pairwise comparison, the priorities list of solution requirements was found. These prioritized issues are the higher most root issues that have been identified through consensus based upon their cause-effect linkages and for the purpose of guiding the solutions requirements.

Conclusions

In this study we have emphasised the need for building an issue list prior to meeting any representative for their inputs for saving time. It is seen that when *issues* are asked based upon the doctors' experience they were seen to be much less than when discussed with the shared issue list for validation and refinement. While effects of some *issues* were more easily validated, others required more participation. By this method, any hospital could develop solutions that are suitable in their own context and arrived at by consensus. This study being exploratory focused on doctors and being a generic approach could be applied not only any healthcare area but also in any organisation engaged in any kind of activity.

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