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A LITERATURE REVIEW ON BLOOD SUPPLY CHAIN MANAGEMENT FOCUSED ON UNCERTAINTY: AN INCLUSIVE APPROACH

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Abstract: In the context of Blood Supply Chain Management, blood supply chain network design is one of the most pivotal planning problems. The stages of blood supply chain management comprise of blood collection, production, inventorying and distribution. The main challenges faced by supply channels are related to shortage, out datedness, and supply chain cost which needs to be minimized. In the current scenario, supply chain network design decisions should be flexible enough to operate under complex and uncertain business environments for many years. Decision-making under uncertainty is a crucial phenomenon and a large number of relevant publications have emphasized its importance. This paper makes an attempt towards reviewing the literature in the fields of blood supply chain network design under uncertainty. This study is organized into two phases. In the first phase, a discussion is made on the types of blood products, potential issues, and stages of blood supply chain management whereas in the second phase, an exploration is made on the optimization techniques for dealing with uncertainty such as recourse-based stochastic programming, robust optimization and fuzzy mathematical programming. The scope of the study lies with capturing the unexplored dimensions related to blood supply chain management that will serve as substantial input for upcoming researchers and practitioners in the field of supply chain management.

Keywords: blood supply chain network design; blood products; uncertainty; robust optimization.

2010 AMS Subject Classification: 90B10, 90C11, 90C30, 90B80, 90B30.

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1. INTRODUCTION

The society is witnessing a burgeoning importance for blood supply chain management. The reason is obvious. Blood forms the base for human existence and survival. Blood has its own unique properties and nothing can substitute it. It can only be formed inside the body and for human society it is a universal need of paramount importance. Considering the operating aspect of blood supply chain management, it starts with a donor and quits with the patient that appears to be very critical along with the issues/problems related to inventory and distribution Oswalt [64]. In blood management technique, initially whole blood is collected from the donors across different regions and the donated blood is retained by permanent or temporary blood donation centers. The donated blood is then transferred to blood banks which employ different processes such as blood purification, filtration and extraction of blood products including red cells, platelets, plasma. The extracted blood products are stored in the blood banks and requested amount of blood products are delivered to the hospitals wherever they are transfused in to patients Sapountzis [71]. The real challenge in blood supply management is that the supply of blood donor is fairly irregular but the demand for blood is high and produce is a minimum of as random. To meet this challenge ,various efforts are to be undertaken towards making the blood availability in the chain, profiling the number of donors who are tending to donate regularly, understanding the seasonal elements affecting donation, campaigns by the government and private organizations e.g.in winter college blood donation campaigns, public holidays Asllani et al. [11].The blood contribution is promising to appropriately predict the number of units of blood required throughout the year ,to ensure that they know the overstock and therefore make the bigger wastage ,the clinicians consciousness of splendid blood ordering and transfusion and the hospital laboratories ability to make sure sufficient stock but have minimal wastage Thomson et al. [58]. It is essential that every staff working at each blood donation center is aware of his/herduties to make the smallest waste of these resources freely distributed. Hence, proper education, training and facts collection are important elements of the blood furnish chain. The online blood bank management system has to generate an e-information about the

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contributor and the managers that are associated with donating the blood. The website and the android software connect all the blood banks for knowing the required volume thereby facilitating the ease of getting entry for the customers Sanchez et al. [49]. The objective of internet site and the app is to offer a solution for the ever-developing requirement of blood grant due to accidents and number of health problem; the gadget has to be developed for access probing into the records about a variety of blood banks and hospitals to understand about their blood stock of different of blood groups. The important objective is to automatize the complete operations of blood bank. The blood bank wants to maintain heaps of record, Cheragi et al. [68]. It would simplify the task of looking for the blood of the required blood team and would instantly get the required type through this website. This is a web-based database application gadget that is to be used via the blood banks or blood donors as imply to advertise the state expensive donation occasions to the public and at the same time permit the public to make the online reservations and request for the blood. This machine has ability to keep a track of the donor's information and stock of blood in the blood bank Dijk et al. [61]. The current research pertains to associate the blood demand in an economical manner. It is very important to know that the requirement of blood products and the shortages lead to the high prices for society, since they will cause increase of the mortality rate, Dumas et al [29]. Many interacting decisions should be created at the strategic policies, strategic method and working plan of the achievement levels. The region unit plagued with the requirement to manage to minimize the outdated, waste and prices, overall to manage the shortage level Eandi et al. [31]. References cited in the obtained manuscript were reviewed to find the additional publications. The study ended up with a total set of 74 manuscripts. To illustrate the distribution of the paper according to the publication date, a distribution figure is included. Figure 1 shows no. of reference papers published with respect to publication date. Figure 2 shows the share of international journals with highest contributions in publishing the reference paper. Figure 3 shows the process of collecting blood in detail.

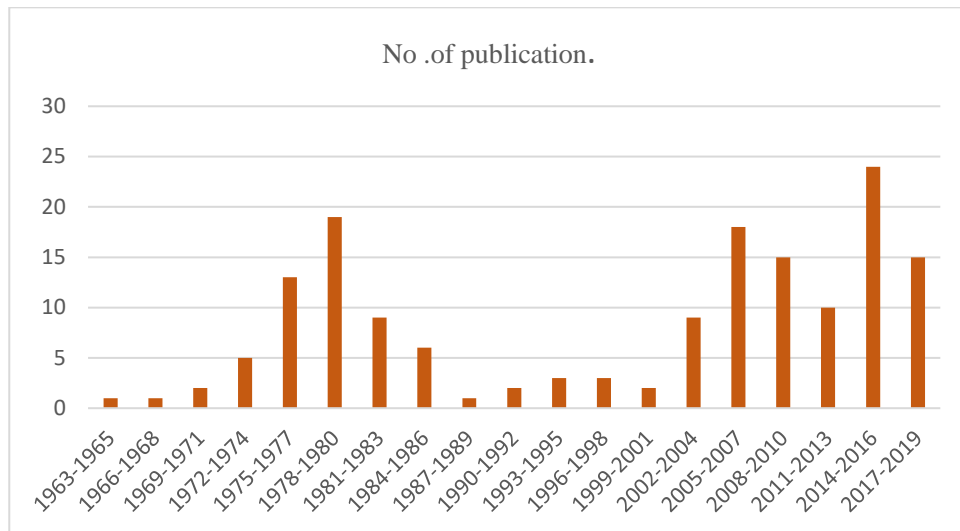


Figure 1: Publication Date Distribution of Reference Papers

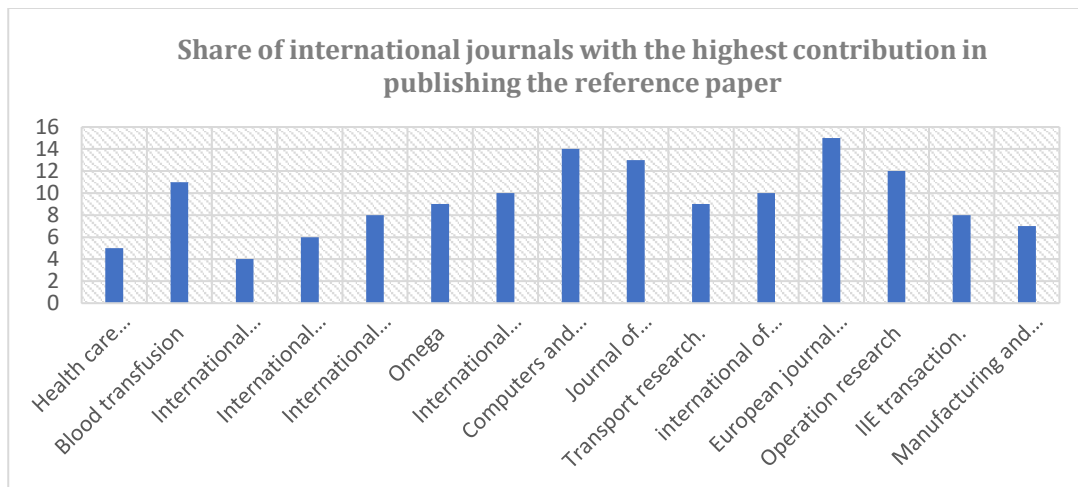


Figure 2: Share of International Journals with Highest Contributions in Publishing the Reference Paper

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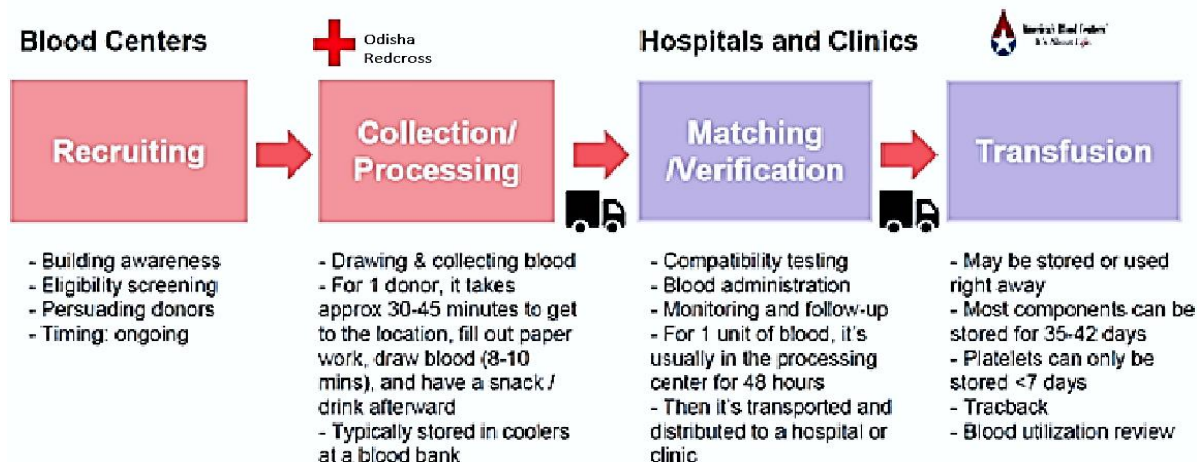


Figure 3: Process of Collecting Blood

The literature review is structured using different perspectives. However; a researcher can query a list of manuscripts according to his specific needs. The residue of this paper is organized as follows; in Section 1: introduction; 2: types of blood product; 3: types of problem; .4: approach level; 5: planning horizon; 6: solution approach; 7: case study; 8: conclusion respectively is discussed and future research direction is also explicated.

2. TYPES OF BLOOD PRODUCT

The components of blood, here mentioned as blood products are whole blood, blood plasma and frozen blood, blood cells, blood platelets. All of these components are consumable. This paper investigates the above-mentioned blood products. White blood cells or different aspects are now not protected in this review. The frozen blood is mainly frozen red blood cells. Few papers mention fresh-frozen plasma and no papers have discussed about using frozen blood Ericson et al. [35]. We feel the issues of frozen pink blood cells, because this is the most important blood product. Nevertheless, most papers are clear about which blood merchandise they are considering, so it can be expected that this is a utilitarian perspective for classifying the literature.

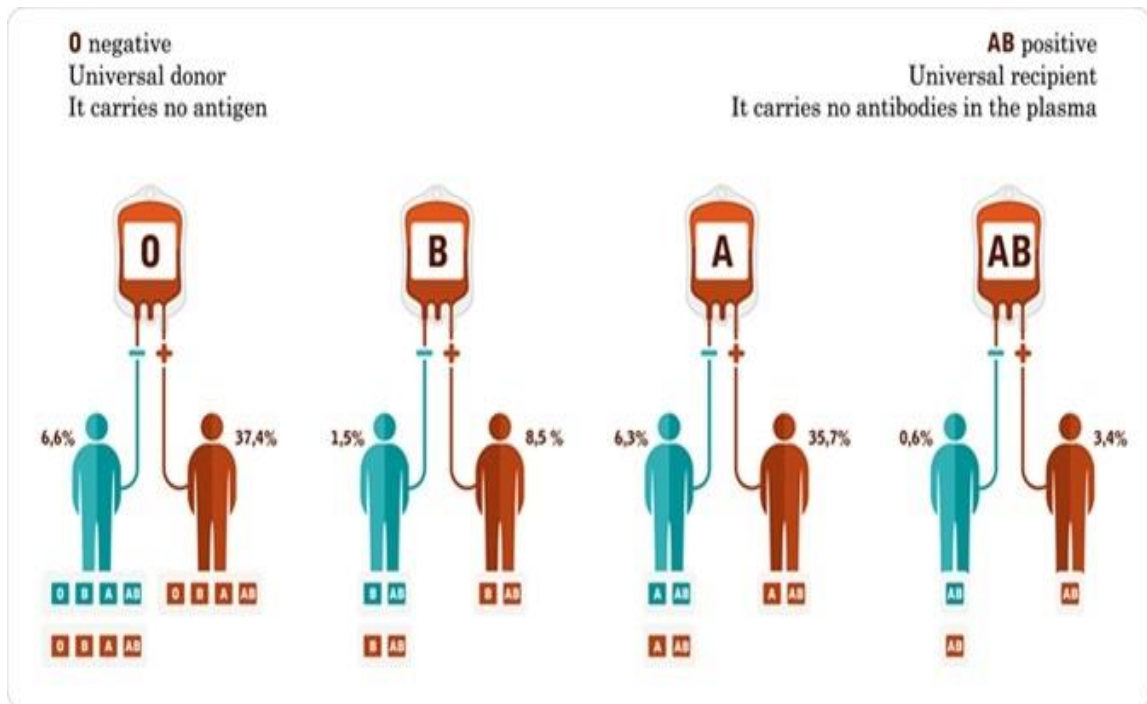


Figure 4: Types of Blood Products

2.1 WHOLE BLOOD

Whole blood contains each of the components of blood that are important for oxygen conveyance and homeostasis, in almost physiologic proportions and fixations. Whole blood can be hidden away refrigeration for as long as 35 days. It fights/prevents infections of diseases. White blood cells (WBCs) producing antibodies to develop immunity against infections. It holds satisfactory hemostatic capacity, however supplementation with explicit blood products, coagulation factors etc. Eskandarpour et al. [32].

The whole blood can be gathered from blood donor in a mobile blood donation center to give feasible stimulation when completely tried put away entire blood or blood segments are inaccessible and the requirement for transfusion is terrible Ferrari [20]. Accessible clinical information propose that entire blood is in any event comparable if not better than segment treatment in the revival of perilous discharge.

2.2 RED BLOOD CELLS

Red blood cells are made in the bone marrow and it lives for about 120 days. It supplies oxygen to different parts of the body and carries carbon dioxide and other waste products. It contains hemoglobin which permits them to transport oxygen and carbon dioxide. Hemoglobin, aside from being a transport molecule, is a pigment.

2.3 PLASMA

Plasma, additionally called blood plasma, is the fluid segment of blood. Plasma fills in as a vehicle mode for transmission supplements to the cells of the different organs of the body and for delivery waste items got from cell absorption to the kidneys, liver, and lungs for discharge. It is the liquid part of blood, composed of about 92% water, 7% vital proteins such as albumin, gamma globulin, antihemophilic factor, and other clotting factors, and 1% mineral salts, sugars, fats, hormones and vitamins. Moreover, a vehicle structure for platelets and it assumes a basic job in keeping up typical pulse. Plasma disseminates heat all through the body and to look after homeostasis Gunpinar et al. [69].

2.4 FROZEN BLOOD

Freezing and thawing are two important operations in plasma fractionation. The fluid component of the blood plasma is mostly made up of water (up to 95% by volume) but also contains glucose, dissolved proteins, hormones, electrolytes, clotting factors, and respiratory gases. Gure et al. [6], Freezing and thawing plasma helps in producing concentrated solutions of individual plasma components, such as clotting factors, for patient transfusion. In order to protect the red blood cells from damaging impacts of freezing, which disrupts the cellular membranes is delivered to this biological fluid Haijeme et al. [61]. The efficiency of preserving frozen red blood cellular stock seems quite low, furthermore a biological fluid also approaches that the cells should be washed after thawing. These examples point out the high expenses Hassian [30]. However, this is fulfilled through maintaining list of donors with exceptional phenomenon.

2.5 BLOOD PLATELETS

Platelets are produced in the bone marrow. The function of platelets is to prevent bleeding. Platelets concentrate preparation is done in triple bags system. A few papers are protected significantly fewer papers approximately blood platelets, as compared to red blood cells and whole Blood. Platelets are that component which have got a very quick projection survival in comparison to different blood products Heidari [17]. This result has increased complexity, in addition to, probably in geographical location. It introduces a new solution approach, closing a gap in the literature which has existed for a long, while due to the complex nature of the problem. Hoseinifriad et al. [74], formulate the perishable inventory problem via the dynamic programming (DP) technique. The problem is that it is very difficult to solve a DP model of realistic size. They dealt with this by suggesting a multistep procedure, combining simulation with dynamic programming.

3. TYPE OF PROBLEMS IN BLOOD SUPPLY CHAIN MANAGEMENT

Supply chain management of Blood consists of various sub-problems. There are two types of problems namely in-bound problem and outbound problem. Inbound problems are consisting of inventory problem and planning, collection of blood products. Imran et al. [33]. Outbound problem consists of scheduling distribution of blood problem.

3.1. INBOUND PROBLEM

In blood supply chain management inbound problems are related with collecting the blood products. Mini-max models are the combination of the model with ordering points with fixed order interval Alfonso et al. [14], represents Inventory allocation problems concern the efficient allocation on the inventory in the supply chain. The issue of the success deals with centralized structure which diestrum the decentralized structure of the blood bank Haijema et al. [61]. The present paper focused on the distribution of blood products from the regional center to a given setup location with random demands. A cross matching policy reduces the issues, when the entire cross matched units are actually used attempt to reduce the blood wastage and alternative

cross matching policy. In the case of single cross matching single unit of blood is reserved for two potential users instead of one. In case of double cross matching ,single unit of blood is reserved for two users instead of one ,while ensuring blood is available for both when it is needed. This technique increases the probability of blood unit being used during the reservation period, Katsalikalı et al. [21], dedicated to store the cross matched blood Kendall [22], who describes the optimal issue for particular classes of inventory problems and example the issue of whole blood from a blood bank is included to accompany Kenneth et al. [23]. This paper classifies in the different sub category like cross matching inventory management and issuing policy.

3.2. OUTBOUND PROBLEM

In supply chain management outbound problem relates to how to increase the supply of blood donor. The network optimization strategic aims to minimize the establishment cost blood collection facility cost, blood delivery cost from the temporary facilities to the main acclimation center. Area of the demand and geographical dispersion of the demand point in each period associated with the cost. The blood donation can directly occur at either temporary facilitation center or permanent facilitation center Gure et al. [6]. Temporary facility center must one or more blood bank at each of the time period. In the view of demand points, the volume of the blood donation in each period and the transportation cost between the facilitation centers must be calculated. In blood distribution system as a sample for a regional blood center and the hospital blood bank deliveries of the blood distribution depend upon a statistical estimation or his hospital. The real requirement is also arranged to adjust when delivery is necessary James et al. [59]. Figure 5 shows the trends in inbound versus outbound problems.

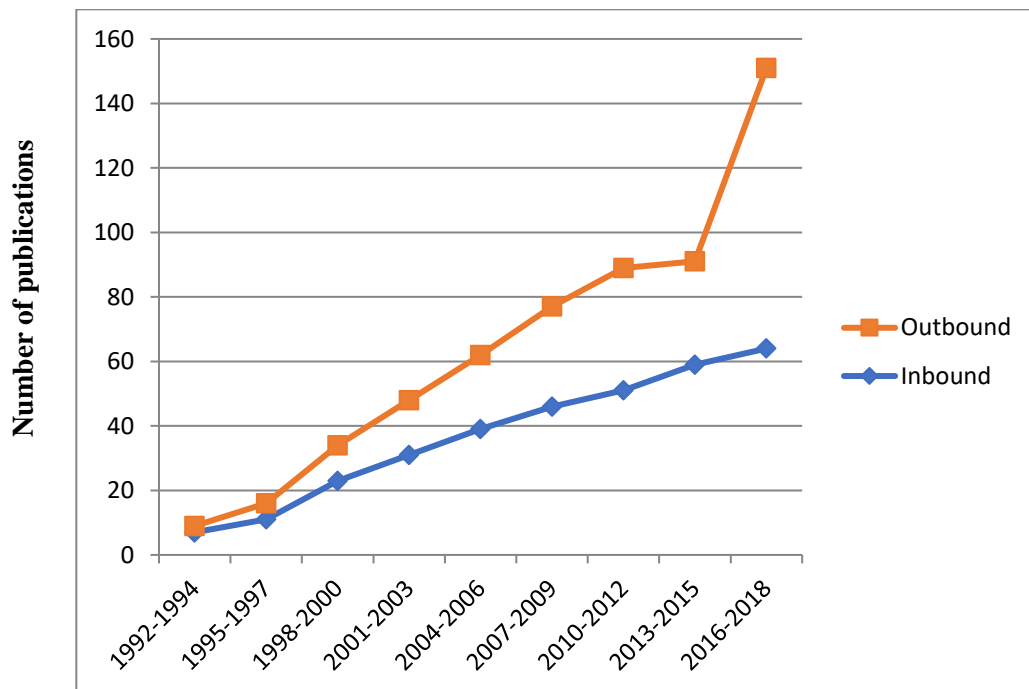


Figure 5: Trends in Inbound versus Outbound Problems

4. APPROACH LEVEL

Current inventory level and the future demand determines the need for the blood products, for example platelet have high demand on low inventory level. Many papers are classified according to criterion is inappropriate. From this point of view, current papers dealing with forecasting are constantly stochastic in observation of the nature of the problem. A further example where this distinction is not relevant is studies dealing with benchmarking. However same type of the blood products is chosen for the transfusion. This paper represents a deterministic model and robust model discussed delivery technique for the blood product. The investigation of deterministic setting up the demand and probability distribution is known for the researcher. In outstanding only 17 papers are settings in the deterministic whereas 42 papers are setting in robust. This paper involves robust setting have always at no paper involving in the deterministic setting. During the last one decade, the difference has only become the larger. This trend represents that

the future research will continue with robust model Kohneh et al. [52]. Figure 6 shows the trends in types of approach.

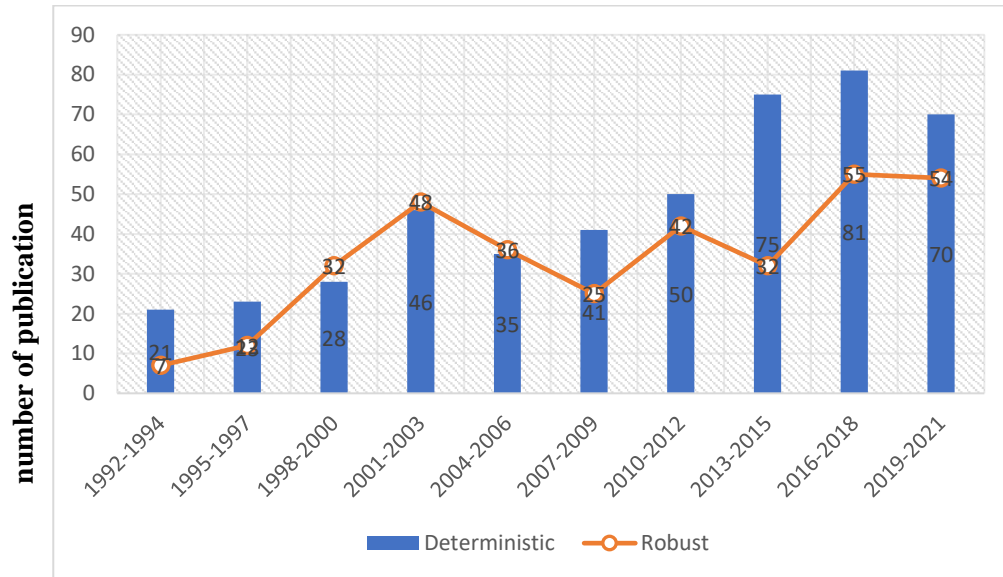


Figure 6: Trends in Types of Approach

5. PLANNING HORIZON AND DECISIONS FOR SUPPLY CHAIN NETWORK DESIGN

Due to the complexity of supply chain network environment, it is essential to consider several planning decisions to achieve the goal of the entire integrated system. These planning decisions remain constant for different time periods and divided into three categories, including long-term, mid-term, short-term level decisions according to their time periods. In the strategic level, there are several crucial supply chain decisions to be made such as the number of locations, capacity of facilities. While it depends entirely on the nature of the supply chain strategic decisions typically hold for about three to five years. Tactical decisions are usually made for three months to three years and operational decisions are often constant for one hour to one trimester kohneh et al. [52]. It should be noted that holding these decisions for certain time period is mostly dependent on the nature of blood supply chain network design and it can vary for different supply chain network design Kendall [22]. The decisions associated with different planning levels are taken into account in the related literature. However, several decisions such as products, price

and routing decisions have been addressed by a new study. Pricing decisions are usually put at the tactical planning level and routing decisions belong to the operational planning level, which are rarely integrated with blood supply chain network design under uncertainty in the related literature. In the majority part of the literature, the decisions have been made for a single period. As explained by Ramezani et al. [66], these single period blood supply chain network design models may be sufficient to obtain a robust configuration for a network and also a robust set of operational and tactical decisions. Another part of the literature has addressed blood supply chain network design problem with planning horizon including multiple periods. In these studies, the periods can be divided into (1) tactical /operational time periods, (2) strategic time periods. In the studies with multiple tactical or operational periods (author), strategic decisions are made at the beginning of the planning horizon while tactical or operational decisions, as products allocation to customers and inventory levels, are able to be changed in different periods throughout the planning horizon.

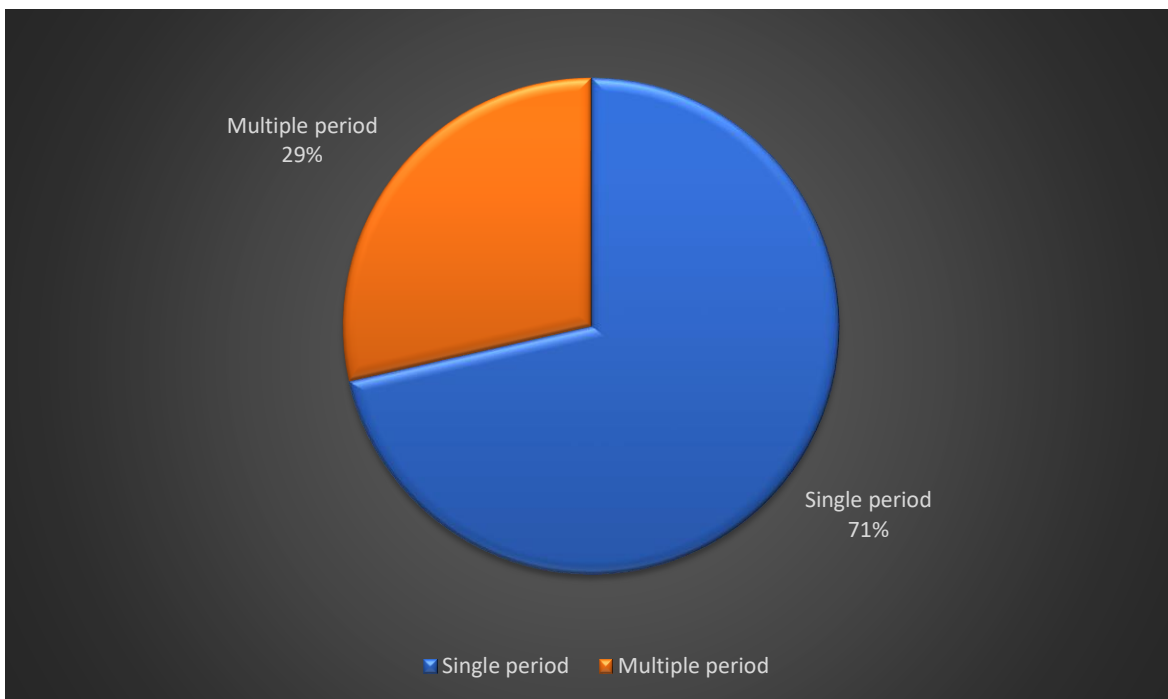


Figure 7: Frequency of Reference Papers in Terms of Their Planning Horizon

Figure 7 classifies the blood supply chain network design models under uncertainty that considered a planning horizon with multiple strategic periods. It also compares the frequency of single period blood supply chain models with multiple ones. It can be drawn from figure 6 that most blood supply chain models under uncertainty are single-period.

6. SOLUTION METHOD

Mansur et al. [26], divides the decision-making environment in to three categories. (i) certainty (ii) risk (iii) uncertainty. In certainty situation, all the parameters are deterministic and known. In risk Situation, all the parameters are uncertain but their values are governed by probability distribution. Problems under risk situation are called stochastic optimization. In uncertainty situation several parameters like cost demand, supply involve the randomness. and there is no information about the probability distribution. The problems under uncertainty are known as robust optimization. The objective of robust optimization is to find the solution which will be better perform under any possible realization of the random parameter and it attempts to optimize the worst-case performance of supply chain network design. Robust optimization, first introduced by mulvey et al. [34], has been adopted as an effective tool for optimal design and supply chain management operating in uncertain environments. Li et al. [10], have been investigated Practical application of robust optimization and production planning. Robust optimization tackles the preferred risk aversion or service level function through expressing the values of critical input data in a set of scenarios. Mulvey et al. [34], define two measures of robustness; a solution to an optimization model is defined as solution of robust if it remains close to optimal for all scenarios of the input data and model robust if it is almost feasible for all data scenarios. Robust optimization openly incorporates the conflicting objectives of solution and model robustness by using a parameter reflecting the decision maker.

6.1. ROBUST OPTIMIZATION IN THE CONTEXT OF BLOOD SUPPLY CHAIN NETWORK DESIGN.

To best our knowledge, few studies have focused on the application of robust techniques for the design of blood supply chain. In this section optimization aspects of the related literature are investigated. Moreover, the reference paper is studied in terms of mathematical modeling, solution method, and optimization technique. Cheragi et al. [68], used the robust optimization technique which deals with the randomness of the parameter. The researchers illustrate the usefulness of the model. Two accurate work methods have been employed and standard deviation of pressure violations under a random number of observations to evaluate the performance of the stability and determination of the models. In some cases, they deal with epistemic uncertainty, when enough data are not available or number of repetitions of a specific action is realized. Kohneh et al. [52], presents a robust optimization model for the supply of blood during the disaster period. The researchers developed a model that can help in blood facility location and allocation decisions for the multiple post-disaster periods. The location decision involves the number and location of permanent temporary blood facilities and allocation decisions concern the assignment of facilities to the blood donors as well as determining blood inventory levels at each period. The proposed model aims to coordinate supply with demand at minimum costs. The projected optimization model is design for an actual blood supply chain, which involved in the supply of blood during the potential earthquakes. Location and allocation are determined in a set of earthquake scenarios developed using different combinations of critical parameters including injury to death ratio, hospital admission rate and blood transfusion rate. Heydari et al. [18], proposed the dynamic, multi objective location-allocation mathematical model for designing a blood supply chain for after disaster period. The mathematical model is consisted from three distinguishable set of nodes; blood donors, temporary blood collection facilities, and processing and storage centers. The objective function is to minimize the maximum possible shortage and minimizing the total cost. The proposed mathematical model proves too useful in short disaster time period. Erickson et al. [35], addresses a new multi-objective and multi-period model for the supply chain planning

under uncertainty considering the quantity discounts. The researcher proposed a mathematical model to maximize the current profit of the distributor by making a balance between the total costs of the supply chain and the distributor companies revenues of selling products and also maximizes the company's expected profit by introducing the brand and taking the risk. They proposed a model is promising approach to run an efficient supply chain. James et al. [59], presents an analysis on robust optimization model to decrease blood shortage, wastage and cost in each scenario. Jabbarzadeh et al. [1], proposed a robust optimization model for blood supply chain network design under different disaster scenarios in which supply chain including blood donors, blood facilities, and blood centers. In their model, blood facilities collecting blood from donors and send to the blood donors. Ramezani et al. [66], developed a new approach to increase blood donor's utility in order to reduce shortages and harmful damages. Parameters including distance of blood donors from facilities, experience factors of donors and advertising budget are considered as the social aspects. Filho et al. [54], Proposed a robust model is curbing the mismatch between surplus and shortage of blood units at blood banks. This proposed model has three main echelons: forecast the demand of blood units at the blood bank; determine the optimal allocation of units from blood banks with surplus to a blood bank with shortage; select the optimal route for the delivery of the allocations. Further, it has been shown empirically with the previous years' data that seasonal auto-regressive integrated moving average (SARIMA) model is a very efficient forecasting methodology in blood supply management. Manatkar et al. [65], designed a mathematical model during several periods based on minimizing the cost of the blood supply chain network and maximizing the reliability of the selectable paths for blood transportation. This model determines the optimal number and locations for establishing the facilities as well as determining the allocation of blood to various facilities, and, on the other hand, optimal routes for blood transportation among facilities. Simamora et al. [48], improved the co-ordination of blood supply and demand. In this regard a robust model is proposed to strive for simultaneous investigation on three independent challenges by which the simultaneous location and capacity decision are supported. The model is also extended to handle the combinatorial risk of uncertainty. In Table 1, all the studies in the area of robust

supply chain network design are categorized with respect to their solution, approaches, objective functions and mathematical model.

Table 1: Studies in The Area of Robust Supply Chain Network Design with respect to Their Solution, Approaches, Objective Functions and Mathematical Model

Sl. No.	Author	P	C	S	W	DI	DE	R	F	SI	ST	IP	HA	SA	SP	MP
1	Pereira et al. [7]		✓											✓		✓
2	Gure[6]			✓										✓		✓
3	Duan et al. [57]		✓		✓					✓				✓	✓	
4	Saucheetal. [53]				✓									✓		✓
6	Chaiwuttisket al. [55]				✓					✓		✓	✓		✓	
7	Cheragiet al. [68]		✓				✓	✓			✓		✓		✓	✓
8	Supountzis [71].				✓							✓				
9	Zhugeet al. [9]	✓										✓		✓		
10	Dumas et al. [29]		✓	✓							✓	✓			✓	✓
11	Gunpinaretal. [69]		✓	✓			✓				✓					✓
12	Heidari[17]		✓								✓				✓	
13	Hosseinradetal. [74]			✓			✓						✓		✓	
14	Jaberazzadehet al. [1]		✓					✓			✓					
5	Arvan[28]		✓			✓	✓									✓
15	Heesetal. [62]		✓	✓				✓				✓			✓	
16	Maenget al. [19]			✓			✓									✓
17	Katsaliakiet al. [53]		✓	✓						✓					✓	
18	Kendall et al. [22]		✓	✓						✓						✓
19	Kohnehetal. [52]		✓	✓		✓							✓		✓	
20	Katslina[55].					✓	✓		✓				✓	✓		✓
21	Ramezaninet al. [66]						✓	✓						✓		✓
22	Simanoraet al. [48]		✓													✓
23	Zahreet al. [47]							✓							✓	✓
24	Kurup et al. [63]			✓	✓									✓	✓	
25	Mohamed et al. [27]		✓					✓					✓			✓
26	Pattnaiket al. [42]	✓		✓	✓				✓		✓	✓				✓
27	Nagurency[2]															✓
28	Sibingaetal.[73]		✓										✓	✓	✓	
29	Hassanian.[30]		✓											✓	✓	
30	Pierskallet al. [8]		✓										✓			✓
31	Eandiet al. [31]										✓	✓	✓	✓		✓
32	Ilmranet al. [33]			✓	✓									✓	✓	
33	Thomas et al. [58]			✓	✓									✓		✓
34	James et al. [59]	✓				✓	✓		✓				✓	✓	✓	
35	Oswalt [64]	✓						✓								✓
36	Sambeecket al. [72]							✓				✓				✓
37	Bosco et al. [67]	✓									✓					✓
38	Sanchez et al. [49]	✓				✓	✓	✓				✓				✓
39	Pattnaik[40]	✓			✓			✓	✓		✓	✓		✓		✓
40	Pattnaik . [42]		✓					✓						✓	✓	
41	Pattnaiket al. [44]							✓						✓		✓
42	Pattnaik.[46]	✓	✓				✓		✓			✓	✓		✓	
43	Asllaniet al. [11]		✓			✓					✓			✓	✓	

P: Profit; C: Cost; S: Shortage; W: Waste; DI: Distance; DE: Deterministic; R: Robust; F: Fuzzy; SI: Simulation; ST: Stochastic; IP: Integer programming; HA: Heuristic Approach; SA: Statistical analysis's: Single period; MP: Multiple periods

7. CASE STUDY

Research on awareness of blood bank has been conducted by some researchers. Yet, no researches have discussed about the policies related flexibility level in blood supply chain management. This is an opportunity to explore the current research. According to National Blood Transfusion Council (NBTC) and Ministry of Health and Family Welfare government of India published a Report on Assessment of Blood banks, investigated there are 91 blood banks in the state of Odisha in 2018, the assessment exercise identified 79 functional blood banks. It is evident from the assessment that blood bank focused on quality improvement systems perform better than others. Discrete simulation method, dynamic programming, integer programming, mixed integer programming, stochastic programming, taguchi method, markov decision method, stochastic optimization, robust optimization Mohamed et al. [27], fuzzy optimization was used to construct to decrease the shortage level, outdate, minimize the cost, expiry the blood Products. Big data analytics tools and techniques would be helpful for the future research work. So, that several improvements are required in blood supply chain management. The current research has focused on shortage level, blood production combination, determining the allocating the permanent facility location and temporary facility location, the quantity of blood requirement for the facility and blood inventory level at end of each period. Moreover, the present research is of new type of review in blood supply chain management, in paradigm of geographical location in Odisha. In blood supply chain, it is investigating that the low quality of information, advertisement budget, long distance, experience factor are the parameters are the cause for poor coordination among the echelons. The Present paper proposes traceability blood system to emphasize the co-ordination among the echelons in the blood supply chain network. The mathematical model could demonstrate the potential profit that will extend from each donor, blood bank and hospital for improving the performance in blood supply chain. In Odisha blood bank, there is a breach about the awareness of the donors. It is normal to find an area that has been well informed, further supply also found another area that has less to none understanding regarding the blood donor. This will reason the large in consistency between the blood supply

from one area to another area and also this is a major cause for the demand will eventually exceed the supply. Therefore, good co-ordination should be required among the nearest blood bank. Across Odisha, Blood quest is divided in two conditions like normal condition and special condition. In normal condition there is no unexpected situation that could cause a sudden point in blood demand. Special condition is a certain condition that affects blood demand directly. Based on the phenomenon adoptive blood management model is indeed. Since the responsibility of blood supply chain management is to changes in every system rapidly and flexible. Blood Management is expected to be adaptive on demand variation and blood supply. The most important thing is to schedule blood transfusions that can make the client want it. Figure 8 shows the adaptive planning scheme in blood supply chain management in Odisha.

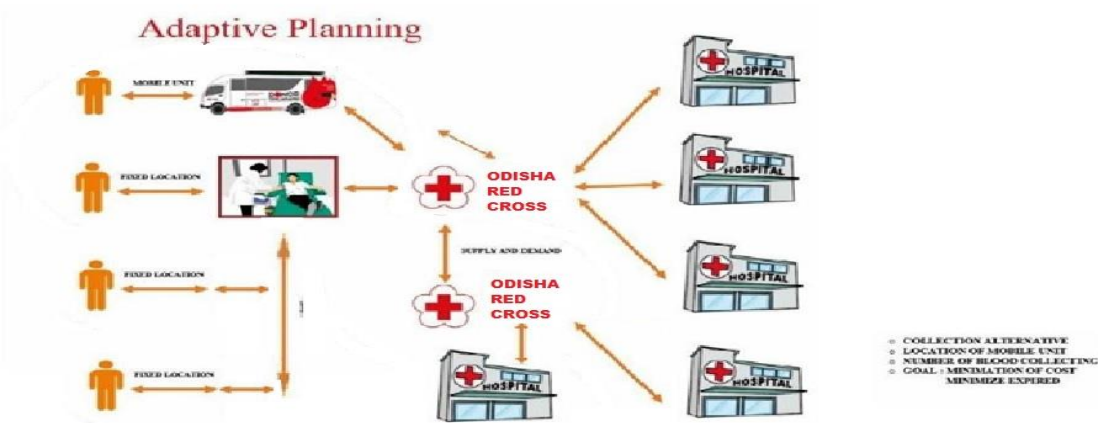


Figure 8: Adaptive Planning Scheme in Blood Supply Chain Management in Odisha

Adaptive planning will be affected by demand characteristics. If the demand pattern will change then it affects the supply level of the blood center. Target level depends on demand behavior and the condition such as normal, emergency, or special condition. The model could not give the quick response to determining the optimum stock towards our time and target. This current research is highly possible to create supply management system to minimize the cost, shortage level and outdate of blood product.

8. CONCLUSION

The literature on blood supply chain management under uncertainty has been growing gradually. Many studies, which appear, every year have a variety of themes, aspects and methodologies. Roughly half of the papers cited in this article were published in the past 10 years and roughly a third were published in the past five years. The growing interest in these problems is due to be increased recognition of the uncertainties faced by most of the industries, as well as to improvements in both optimization technology and raw computing power. When we think of blood supply management under uncertainty, many of us think only of the most common objectives (i) minimizing expected cost (ii) minimizing maximum regret (for robust problem) (iii) minimizing shortages (iv) outdates of the blood products, yet a widespread variety of other approaches has been planned: This study reveals the research opportunity in the field of blood supply chain at the strategic level, tactical level and operational level. Many research opportunities required is to build the practicality models based on real world applications and handling computational aspects to solve large size problem. Many of these approaches have modeling, and analytical, and computational advantages over the traditional objectives. We have explored these alternative measures with intention of providing a foundation for researchers doing work in this related fields. Table 1 describes the papers that provide a detailed case study in which the proposed model is applied to a real problem, whether or not the resulting solution were implemented. Although the list of application is varied, it is substantially shorter than list of applications facility location models. In our opinion, the lack of successful applications can be explained, at least in part, by the cumbersome data requirements of many stochastic models, which often require estimates of many stochastic models, which often require estimates of many parameters over a range of hypothetical scenarios. Robust optimization reduces the data burden by hedging against a set of scenarios whose probabilities, or even whose composition, need not be known explicitly. Undoubtedly, there are many other research avenues that will prove to be productive: we hope that this survey paper helps to facilitate future research in this area.

CONFLICT OF INTERESTS

The author(s) declare that there is no conflict of interests.

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