

A Scientific Design Approach for Blood Transfusion Service in Hospitals

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Abstract

In all the hospitals Blood Transfusion Service (BTS) design has been always a very challenging task for the architects and hospitals administrative as minuscule faulty design may lead to a slow disastrous outcome. These faults may affect overall efficiency and working environment in hospitals in negative perception therefore a scientific and systemic approach of design needs to be implemented during design process by keeping all relevant considerations at conceptual stage. In this paper an easy and comprehensive study will help the readers to frame out and evolve a basic guiding factors to set up a well designed and functional BTS unit in hospital building that can further be advanced by following these fundamentals albeit this study also brings an advanced and contemporary parts of the practical field by means of graphs, tables and drawings etc.

Keywords: Blood transfusion system; Blood bank; Donor; Serology; Issue counter

Introduction

Blood transfusion is the process of transferring the blood from one person to another person for treating an ailment that causes suffer to a patient. In modern practice the components of blood like red cells, white cells, plasma, clotting factors and platelets etc. are replaced or added into new extracted blood as per treatment condition but in old medical practice it was not in like aforementioned manner, the whole blood was to replaced completely that needed only one place to perform required procedures over blood. With the advancement of medical technology the task to replacing cells has become possible where hospital needs to be designed with various spaces to perform the replacing and transferring activities. Architects and designers are suggested to make them conversant with sound awareness about correct procedures regarding blood transfusion that will help to derive the spaces in an efficient way [1]. All over the world more than 70% countries are bound to abide by National Blood Policy of that particular nation and more than 65% countries have specific legislation for the safety and protection of blood like in India Drugs and Cosmetic Rules, Indian Red Cross Society are followed. Before further explanation in detail it would stand designers in good stead to know few things that are disseminated below.

Objective

The primary objective of providing blood transfusion service has to fend safe and adequate quantity of blood and its products or components to the patient in an efficient and effective manner by means of architectural treatment should be given to the spaces. Generally this achieved by blood donation, testing of blood samples, storage and issues for transfusion but physical parameters play a vital role to enhance the work efficiency of the users in blood transfusion service [2].

Corrective measures taken by government of India

In 1996 government of India passed a bill in India that would watch out all blood transfusion services in India by enhancing quality control. Following measures were taken:

- To establish a National Council for Blood Transfusion in every state and union territory.
- All blood banks would be licensed.
- Professional blood donating practice was stopped.
- To amalgamate a legislation to regulate and control the process of collection, storage and issue of blood components.

All the hospitals would be permissible to house blood transfusion service only if it fulfill all requirement prescribed by India Drug and Cosmetic Rule, 1999.

Transfusion service functions

There are seven common functions that are performed in BTS shown in picture below. Designing of BTS should focus on these procedures in order to derive and decide the spaces with appropriate sizes and scale as hospital management authority demands.

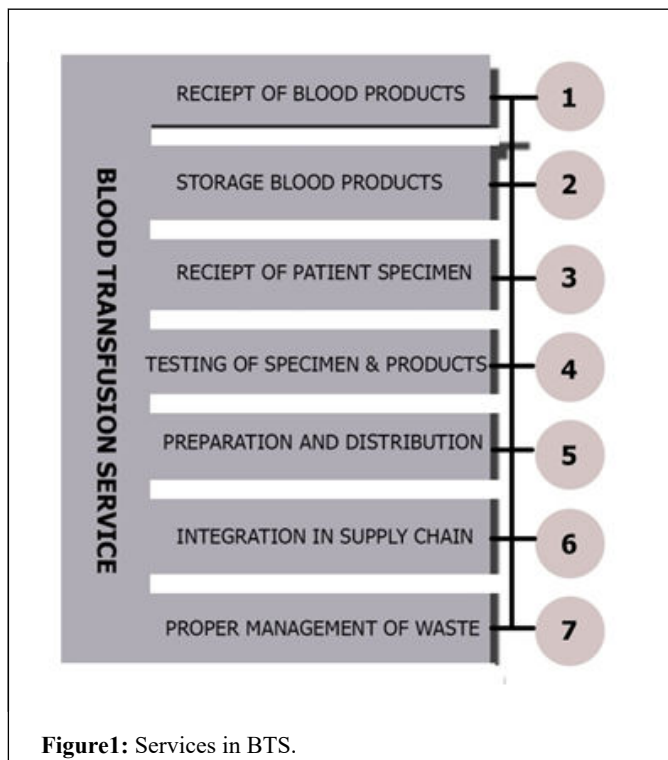


Figure1: Services in BTS.

Transfusion service flow

In hospital there are two types of samples that are received one is of blood sample and second is specimen sample both are received in blood transfusion service unit where detailed study is done in the form of test in order to match the required level. The correct service flow should be adopted by the architects and planners in designing of BTS in any hospital. A detail service flow is described below in Figure 2. Patient blood sample and specimen arrive in laboratory preferably in common place where these samples are tested, analyzed and resulted [3]. Laboratory should have automated and non automated task performing spaces that enhance the efficiency of working environment. Specimen and blood sample are crosshatched and then distributed as shown in Figure 2 below.

Design Developing Methodology and Deriving Spaces

Architects and planner should understand the connectivity of spaces with respect to staff and related functioning in order to derive the spaces before their hands get dirt on designing. Once the architects understand fundamental functions of the department it becomes easy for them to draw a concept on pre-design stage. In BTS analysis of spaces all related study have been suggested four main activities are carried out-

Receiving

In BTS there should be spaces for receiving blood and blood products that are brought here by using pneumatic tube system or couriers. Proper facility should be provided to dispose waste safely without affecting internal functions of the space. As for its location can be adjacent to product storage area for smooth function.

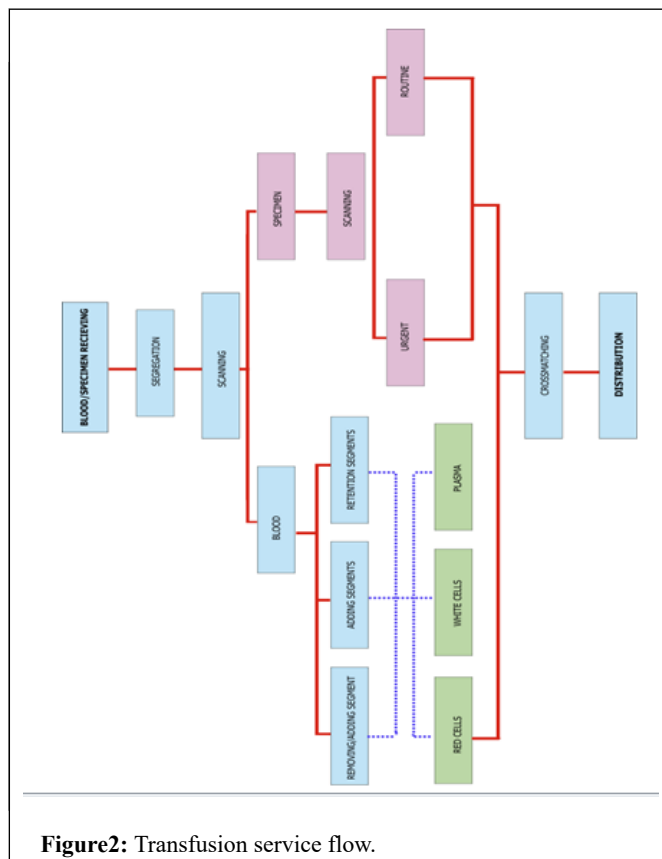


Figure2: Transfusion service flow.

Storage area

Once the products are received they are stored in refrigerator, freezers, incubators immediately under suitable environmental conditions.

Testing area

In this zone blood samples are tested by means of automated or non-automated systems with additional testing facility if required. All testing spaces should be merged in a systematic way that can be accessed easily in a flow without breaking a flow of circulation if possible [4].

Distribution area

This is one the most important area in BTS where tested and crosshatched blood samples are distributed to the customers by using pneumatic tube system, service window or any other methods. Here the working staff should pay an attention to dispensing of products so that no haphazard condition should be created and proper area for accommodating refrigerator, incubators etc. should be fenced. After having a profound insight of spaces and their relevant positioning with others spaces hospital planners can start off the process to evolve basic zoning and concept as shown below in Figure 3.

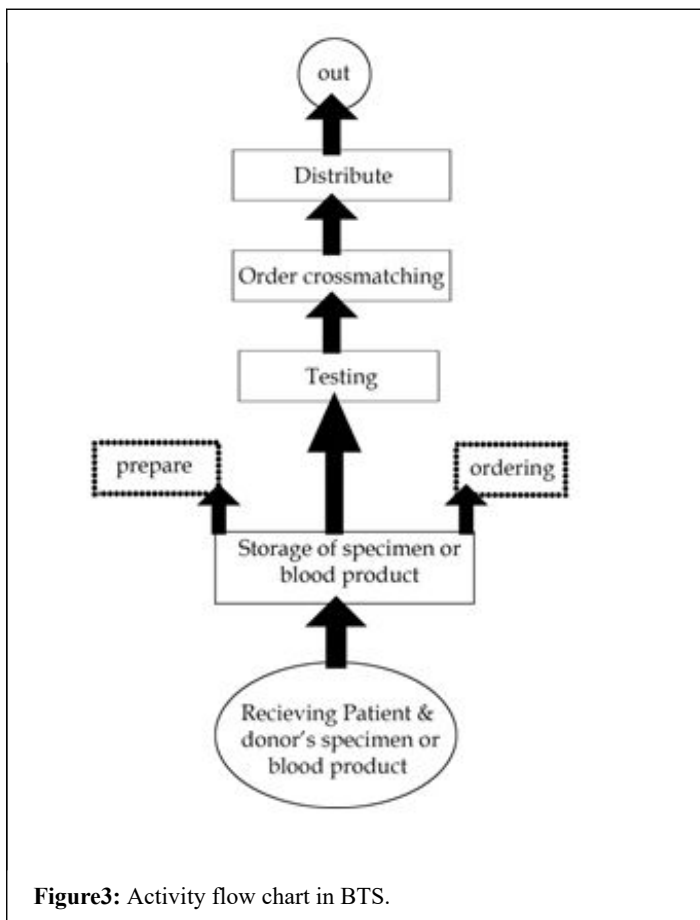


Figure3: Activity flow chart in BTS.

Apart from evolving spaces and circulation flow of staff and information architects need to segregate waste from BTS unit in safe manner. The working staff should be well conversant with the position of pneumatic tube and others relevant services for dispensing the facility to needful department of patient directly. Following are the points that should on architects' finger tips to design a BTS in hospital buildings.

- Blood products receiving point.
- Location of pneumatic tube system.
- Locations of spaces where blood products are to be supplied.
- Correct and efficient movement of staff.

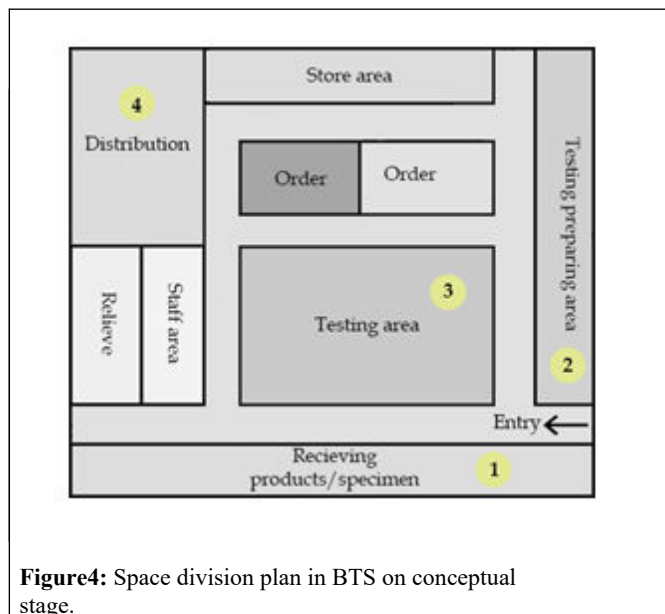


Figure4: Space division plan in BTS on conceptual stage.

Physical Areas Breakup

Following are the spaces in BTS in any hospital

Public access areas

Below the table describes the common public areas used in BTS with appropriate size as per professional practice in medical architecture. It may include other supporting spaces that requires a scope for future expandability if possible by giving 40% extra circulation space in any side by means of providing wall (Table 1).

S. No	Public Areas	Access	Area(m2)	Tentative area
1	Reception		1.5 per person	40-50
2	Toilet		-	1.44 as per toilet norms(NBC)
3	Waiting area		1.85 per person	-
4	Donor bleeding room		-	20-25
5	Medical exam room		-	10-12
6	Refreshment		-	12
7	Kitchen/pantry			8-10
8	Aphaeresis(Machine used for blood donating)			30
9	Daycare or therapeutic			40-42
10	Counseling room			10-12

Table1: public access areas used in BTS.

Laboratory areas

Laboratory areas in BTS can be separated with basic primary areas with sufficient space shall be provided for minor addition or subtraction in future if needed. Many additional areas can be added or subtracted as per the requirements of the BTS.

S. No	Public access areas	Area(m2)	Tentative area
1	Blood and specimen product receiving area	-	18-20
2	Donor blood storage area		18-20
3	Transfusion-transmissible infection lab area		30
4	Component separation area		30
5	Washroom and disinfection area		18-20
6	Emergency lab storage area		12-15
7	Specialized lab area		25-30
8	Issue counter		10-12

Table2: Laboratory areas in BTS.

Planning Parameters in Modern Blood Transfusion Unit in Hospitals

Following are the key planning parameters and related issues in BTS that are required to publish in architects notice before starting design:

Location

Blood Transfusion System should be placed preferably on ground floor centrally placed from all relevant departments with independent administrative and technical services. It should have separate entry and exit with common entries too for visitors via enough wide corridors connects to waiting area [5].

Reception

Sufficient reception area should be equipped with two registration counters one for patient and one for donor. At the reception one small room can also be provided as a testing lab optionally to declare donor fit or unfit for blood donation.

Donor room

Donation room should have comfortable beds as per requirements posed by hospital management with proper sterile equipment, refrigerator, resuscitation machine.



Figure5: Reception counters (metro blood bank Chennai-GDS).

Screening room

This is a room which is provided for screening the health condition of donor consulted by the authorized person with written policies and guidelines. Here the final decision is taken for blood will be donated or not due to some health history.

Laboratory area

This is perhaps the most indispensable area of BTS that is akin to general lab in terms of functionality with proper equipment suggested by experts. The planning guidelines of BTS laboratory follows the same procedure as of common clinical labs.

Preservation and storage area

Collected samples of blood and specimen are stored in deep refrigerator under suitable temperature and environment with due care. No food or other edible should be stored except preserving blood samples.

Record room

An optimum sized record room with window counter should be provided to facilitate all types of written records at the time of demand of patient, doctor etc. Daily basis all activities are registered in this room [6].

Admin area

Sufficient numbers of offices for all authorized person, seminar and meeting rooms, technician room, server room etc. should be designed with proper toilet facility. A list of areas with their sizes is given above in table.

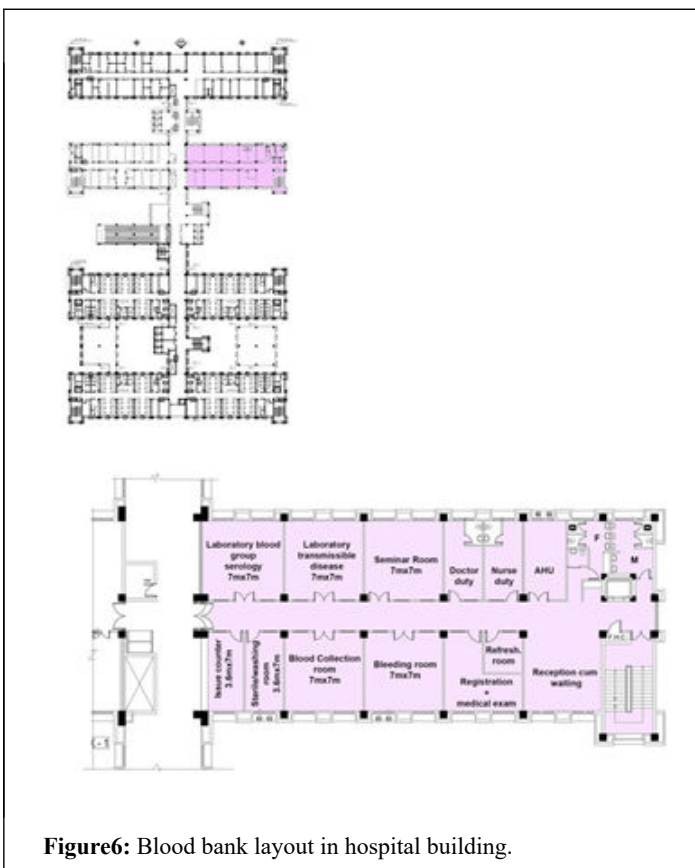


Figure6: Blood bank layout in hospital building.

Waste management facility: Although waste generated from BTS has never been great concern due to its less quantity but a safe and hygienic disposal is needed. These are few very essential spaces should be dedicated in designing of BTS that are also discussed in tables drawn above with their suggested areas many other spaces can also be provided if there is need (Figure 7 and 8). Few examples of Blood transfusion system and blood bank in hospitals are given below for better comprehension; these drawings should be referred for educational purpose only.

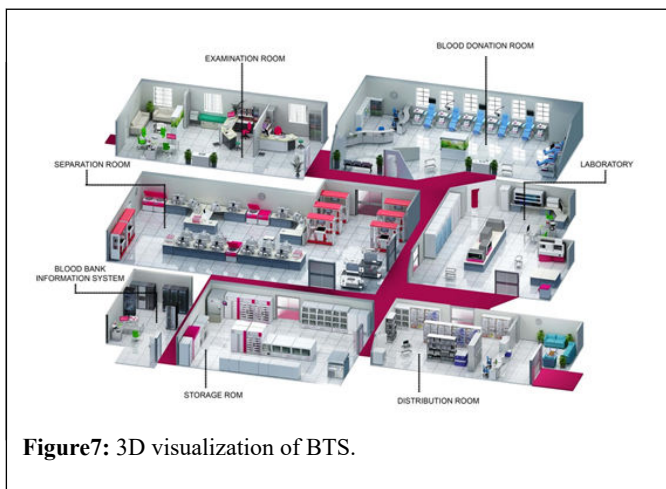


Figure7: 3D visualization of BTS.

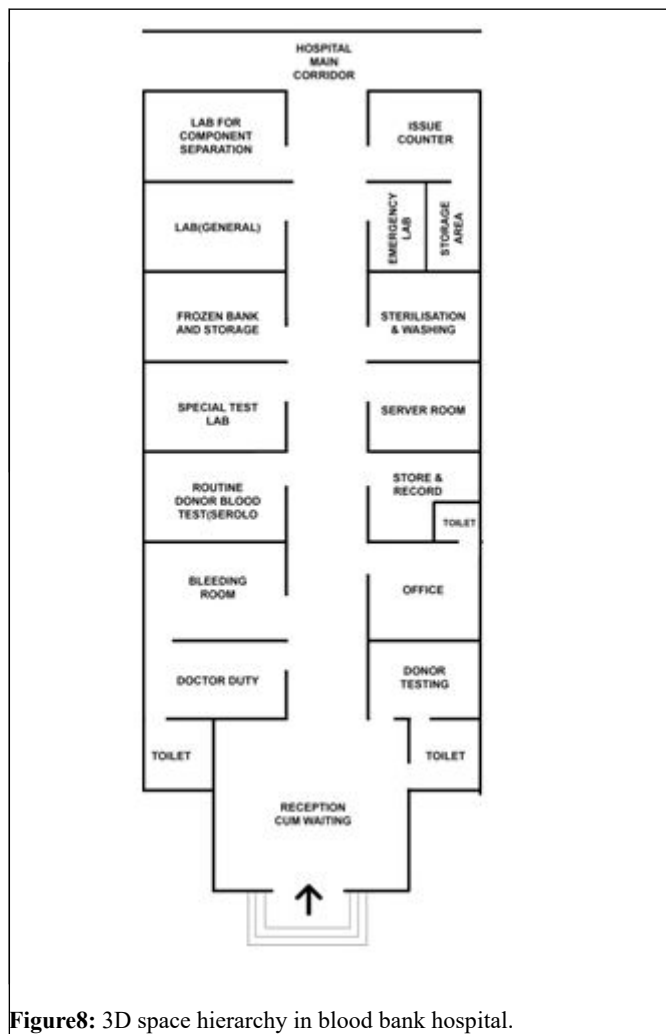


Figure8: 3D space hierarchy in blood bank hospital.

Conclusion

Blood related services have been an integral part of the laboratory department in many hospitals but in bigger hospitals a separate and well designed, efficient and functional Blood Transfusion Service should be provided with authenticated licensing system. In small sized hospital this service can be merged with laboratory services but a separate provision for entry should be facilitated.

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