

## Staff Nurses' Knowledge of Blood Transfusion and Its Impact on Key Performance Indicators of Blood Components Administration: Can We Bridge the Gap?

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### Abstract

*Context:* Due to increasing demand for blood components, injudicious utilisation of blood products will definitely have serious implications in resource constrained settings. The staff nurses should be fully aware of all the pitfalls and its associated consequences right from receiving the blood bag from the blood bank, till it is transfused to the patient.

*Aims:* This study aims at analysing the impact of the knowledge scores of the staff nurses in Blood transfusion practices on the Key performance indicators of Blood Component administration.

*Settings and Design:* This study was conducted in Blood bank, Saveetha Medical College Hospital, Thandalam, Chennai, Tamil Nadu. The study population comprised of 220 staff nurses in the period of 2015–2017.

*Methods and Material:* This is an observational study with a cross sectional design and quantitative data analysis. The study is based upon a questionnaire approved by the hospital ethical committee and retrospective data collection of the key performance indicators of blood component administration, from the case sheets of the patients who received blood transfusion.

*Statistical analysis used:* Knowledge scores of the staff nurses were computed using the results of the questionnaire. The percentage of key performance indicators of blood component administration were calculated based on a checklist.

*Results and Conclusion:* The knowledge scores of the staff nurses was found to be insufficient which contributed to low fulfilment of key performance indicators. Multiple steps were taken to improve the knowledge of the staff nurse, in blood transfusion, which eventually lead to a favourable increment in the key performance indicators of Blood component administration.

**Keywords:** Blood Components; Performance Indicators; Blood Transfusion.

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**Introduction**

Blood is an inestimable scarce resource obtained from motivated altruistic human donors, who donate blood for their fellow mankind at the needy hours. There is an ever increasing demand for blood products nowadays and in many situations, the supply never meets the demand. But in many hospitals, blood and blood components are frequently utilised without following the appropriate practices and policies associated with blood transfusion, as advocated by International guidelines for Blood transfusion.

Blood transfusion is an elaborate complex procedure and performing this procedure for a patient requires adequate skills and knowledge. Errors caused due to ignorance and negligence in blood transfusion practices in one of the major causes of mortality due to blood transfusion. Inappropriate transfusion of blood and blood components will not only lead to wastage of resources but also it might be the root cause of various adverse transfusion reactions among blood component recipient, endangering their lives and also placing the reputation of the hospital at stake [1].

The outcome of blood transfusion is entirely dependent upon the knowledge and expertise of

the medical team, which comprises of the Doctor ordering for a blood transfusion, the blood bank team and the staff nurses who execute blood transfusion. Thus it is very crucial that the staff nurses are fully aware of all the pitfalls and its associated consequences right from receiving the blood bag from the blood bank, till it is transfused to the patient [2]. Injudicious utilisation of blood products will definitely have serious implications in resource constrained settings. Hence, continuous monitoring of the performance indicators in blood component administration is imperative to improve the blood transfusion services in a hospital

**Materials and Methods**

This is an observational study with a cross sectional design and quantitative data analysis. The study is based upon a questionnaire approved by the hospital ethical committee for assessing the knowledge score of the staff nurses in blood transfusion and retrospective data collection of the key performance indicators of blood component administration, from the case sheets of the patients who received blood transfusion [Table 1]. The study was conducted in June 2016 and the retrospective data was collected from the period of May 2015 to June 2016.

**Table 1:** Performance Indicators for Blood administration.

	Topics	Met	Not met
	Pre transfusion steps		
1	obtaining consent from the recipient for blood transfusion		
2	Checking the base line vital status of the recipient before transfusion.		
3	starting the blood transfusion within 30 minutes from the blood bag issue		
4	Cross checking the details on the blood bag and that of the patient		
5	checking the blood bag for physical deterioration before transfusion		
6	Performing hand hygiene procedure before starting the blood transfusion		
	Transfusion steps		
7	Checking the vital status of the recipient every half an hour.		
8	Looking for signs and symptoms of adverse transfusion reactions		
	Post transfusion steps		
9	Checking the vital status of the recipient after the completion of transfusion		
10	Proper disposal of blood bags		
11	Informing the blood bank staff in the event of adverse blood transfusion reaction		
12	Submitting appropriate blood samples of the recipient, to the blood in the event of adverse transfusion reaction		

### Study Population

Staff nurses who are directly involved with patient care where blood transfusions were done frequently were selected for this study. This includes Emergency and critical care, ICU, Surgical wards, Operation theatres, Post operative wards, Medical Wards, Cardiology units, Urology units, Gastroenterology units, haematology and Oncology units, haemodialysis units, ENT ward and orthopaedic wards [Table 2].

**Table 2:** Frequency distribution of staff nurses posted in various departments.

	Departments	N	%
1	Emergency medicine	18	8.18%
2	operation theatre	42	19.11%
3	labour wards	10	4.54%
4	Medical Intensive care units	16	7.27%
5	Surgical intensive care units	19	8.63%
6	NICU	6	2.76%
7	Hemodialysis	10	4.54%
8	Post operative wards	25	11.36%
9	Medical wards	10	4.54%
10	surgical wards	10	4.54%
11	pediatric wards	10	4.54%
12	Orthopedic wards	8	3.63%
13	hematology wards	18	8.18%
14	Oncology wards	18	8.18%
	Total	220	100%

### Ethical Considerations

Ethical committee approval was obtained from the Hospital ethical committee. Participant information sheets were distributed to all the staff nurses taking part in the study. Confidentiality of the survey results and anonymity were guaranteed and signed consent papers were obtained from all the staff nurses.

### Sample Selection for the Survey

The list of registered staff nurses working in our hospital was obtained from the Department Human Resource and Development of our hospital. All staff nurses who are involved directly with patients care with experience of more than 3 months were selected for the study. A total of 220 staff nurses were selected. Simple random sampling technique was used to select the sample via the Statistical Package for Social Sciences (SPSS), version 11. SPSS Inc. Chicago, IL, USA). Sample recruitment was followed by data collection.

### Questionnaire Details

Before the commencement of the survey, the content of the questionnaire for its validity and reliability was ascertained by appropriate consultants in Transfusion Medicine. The questionnaire was divided into three portions, i.e., part A, part B and part C. Part A included questions about age, gender, educational qualification, years of experience and demographic details about the staff nurse filling the questionnaire. [Table 3,4]

The second portion part B included 30 multiple choice questions with one correct answer. The questionnaire was designed in such a way, that the questions included topics on blood bag processing, storage, compatibility testing, blood components release, patient bedside checking, recipient monitoring, reporting of discrepancies, blood bag physical examination, identification of recipient adverse transfusion reaction, obtaining consent for transfusion, recording the events during the transfusion process, blood bag disposal and tracing of component disposition [Table 5].

The final portion of questionnaire part C included questions regarding the clarity of the questions, the clinical importance of the questions and understanding the language used in the questionnaire. Part A questions were not awarded any marks. Part B questions fetched one mark for every correct response and zero marks for every incorrect responses. Part C questions had gradable responses according to the comprehension of the staff nurses. (Tables 6-10).

**Table 3:** Frequency distribution according to the age group of the staff nurses.

Age Group	N	%
23 to 30 years of age	27	12.20%
31 to 37 years of age	84	37.80%
38 to 44 years of age	69	31.60%
45 to 51 years of age	21	9.50%
52 to 58 years of age	19	8.90%
Total	220	100%

**Table 4:** Frequency distribution of staff nurses according to their years of experience n = 220

Years of Experience	Male	Female	Total (N)	%
<2 years of experience	10	66	76	34.55%
2-5 years experience	8	85	93	42.27%
> 5 years of experience	11	40	51	23.18%

**Table 5:** Frequency distribution showing the performance of staff nurses, in the first category of questions according to the years of experience

Blood Bag Storage Details	Overall Performance (n = 220)		< 2 Years of Experience (n = 76)		2-5 Years of Experience (n = 93)		> 5 Years of Experience (n = 51)	
	Numbers	%	Numbers	%	Numbers	%	Numbers	%
1 Storage temperature of packed RBC	47	21.36%	16	21.20%	20	21.50%	11	21.50%
2 Storage temperature of platelet	39	17.72%	8	10.50%	19	20.40%	12	23.50%
3 Storage temperature of frozen plasma	52	23.63%	11	14.40%	14	15.05%	29	56.80%
4 Volume of packed RBC	56	25.45%	14	18.40%	23	24.70%	19	37.20%
5 Volume of platelet	18	8.18%	3	3.90%	5	5.30%	10	19.60%
6 Volume of plasma bag	61	27.72%	16	21.05%	20	21.50%	25	49.00%
7 Volume of whole blood	72	32.72%	24	31.50%	20	21.50%	29	56.80%

**Table 6:** Frequency distribution table showing the third category of questions according to their years of experience

Transfusion procedures observations (TP)	Overall Performance (n = 220)		< 2 Years of Experience (n = 76)		2-5 Years of Experience (n = 93)		> 5 Years of Experience (n = 51)	
	numbers	%	numbers	%	numbers	%	numbers	%
1 Identifying adverse transfusion reactions	35	15.90%	5	6.50%	15	16.12%	15	29.40%
2 Most common adverse transfusion reaction	59	26.81%	17	22.30%	21	22.50%	21	41.17%
3 steps to be taken in the event of adverse reaction	89	40.45%	27	35.52%	34	36.55%	33	64.70%
4 High incidence adverse transfusion reaction	69	31.36%	19	25.00%	22	22.95%	28	54.90%
5 low incidence adverse transfusion reaction	12	5.45%	10	13.15%	4	4.30%	8	15.60%
6 Identify mismatched blood transfusion	89	40.45%	21	27.60%	27	29.00%	41	80.30%

**Table 7:** Frequency distribution table showing the fourth category of questions according to their years of experience

Post transfusion procedures observations (POTP)	Overall Performance (n = 220)		< 2 Years of Experience (n = 76)		2-5 Years of Experience (n = 93)		> 5 Years of Experience (n = 51)	
	numbers	%	numbers	%	numbers	%	numbers	%
1 adverse transfusion reaction workup	29	13.81%	11	14.47%	8	8.60%	10	19.60%
2 blood bag disposal	79	35.01%	21	27.60%	26	27.94%	32	62.70%
3 post transfusion care	57	25.90%	12	15.70%	22	23.60%	23	45.09%

**Table 8:** Frequency distribution of overall knowledge scores of staff nurses according to their experience

Overall knowledge scores according to years of experience	Average	Minimum	Maximum
1 < 2 years (n = 76)	16.60%	0	50%
2 2-5 years (n = 93)	17.21%	3.30%	50%
3 > 5 years (n = 51)	37.57%	13.30%	73.30%

**Table 9:** Frequency distribution showing the numbers of staff nurses, according to their knowledge scores.

Knowledge score grading of the staff nurses according to years of experience			
Years of experience	< 25% of Knowledge Score	25% - 50 % of Knowledge Score	> 50 % of Knowledge Score
1 < 2 years of experience (n = 76)	63	12	1
2 2 - 5 years of experience (n = 93)	79	13	1
3 > 5 years of experience (n = 51)	9	31	11
Total	151	56	13
%	68.80%	25.45%	5.90%

**Table 10:** Key performance indicators, involving the pre transfusion, transfusion and post transfusion steps. (Total number of blood transfusion from June 2015 to May 2016, n = 2482)

Sl. No	Key Performance Indicators of blood administration	Percentage of compliance (June 2015 to May 2016) (n= 2482 )
1	Obtaining consent from the recipient for blood transfusion	10%
2	Checking the base line vital status of the recipient before transfusion.	32.60%
3	Starting the blood transfusion within 30 minutes from the blood bag issue	17.40%
4	Cross checking the details on the blood bag and that of the patient	27.50%
5	Checking the blood bag for physical deterioration before transfusion	19.20%
6	Performing hand hygiene procedure before starting the blood transfusion	16.90%
7	Checking the vital status of the recipient every half an hour.	22.40%
8	Looking for signs and symptoms of adverse transfusion reactions	31%
9	Checking the vital status of the recipient after the completion of transfusion	11.90%
10	Proper disposal of blood bags	21.50%
11	Informing the blood bank staff in the event of adverse blood transfusion reaction	27.50%
12	Submitting appropriate blood samples of the recipient, to the blood in the event of adverse transfusion reaction	23.70%

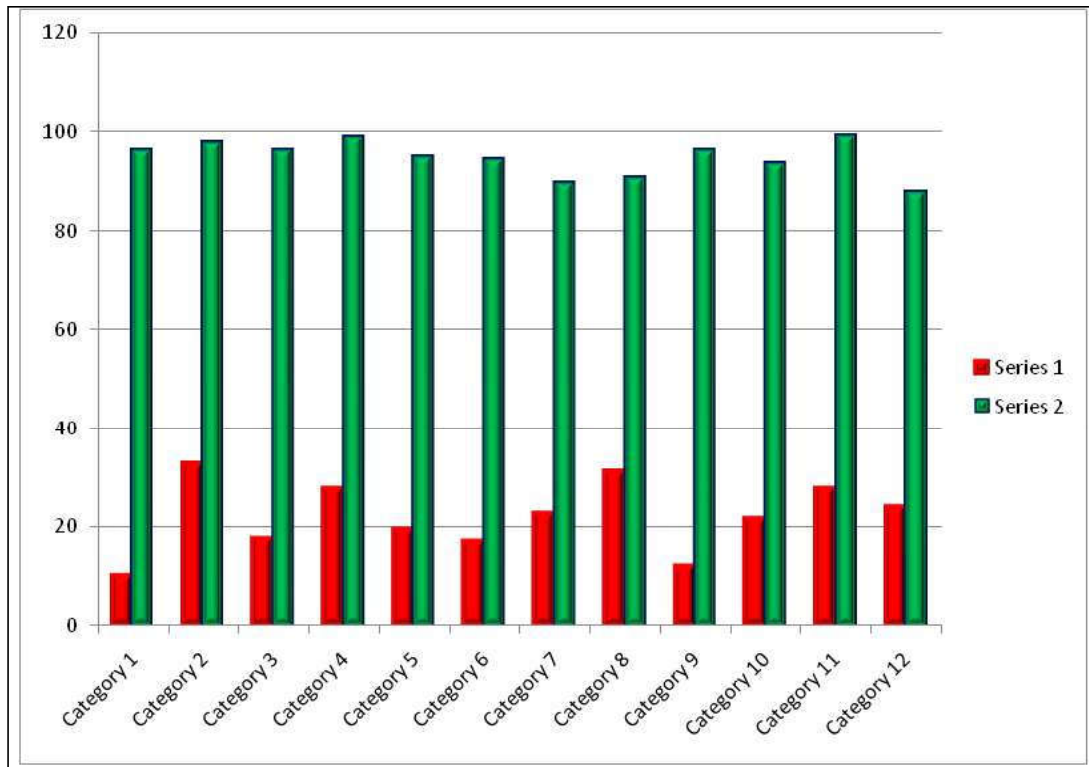
*Performance Indicators in Blood Component Administration*

Performance indicators are indispensable tools which various stakeholders in the Blood Transfusion centres should implement to improve on quality performance. Performance. Monitoring is one type of internal audit, which helps us to improve our quality standards in transfusion practices. They are the critical procedure which has to be executed during the pre transfusion period, transfusion period and post transfusion period for assuring quality in blood transfusion. Identification

of CCP's and KE's are fundamental for monitoring the process of blood transfusion, from which the performance indicators could be monitored. The following performance indicators had been identified and data was collected for a period of 1 year from May 2015 to June 2016. The performance indicators which met the requirement were given 1 mark and those which were not met as per the requirement were given 0 marks. Data collected were entered in a tabular form and the results were analysed in percentages, against the number of blood component transfusions done from May 2015 to June 2016 [Table 10,11].

**Table 11:** Key performance indicators, involving the pre transfusion, transfusion and post transfusion steps.(Total number of blood transfusion from June 2016 to May 2017, n = 3265)

Sl. No	Key Performance Indicators of blood administration	Percentage of compliance (June 2016 to may 2017) (n= 3265)
1	Obtaining consent from the recipient for blood transfusion	96.5%
2	Checking the base line vital status of the recipient before transfusion.	98%
3	Starting the blood transfusion within 30 minutes from the blood bag issue	96.4%
4	Cross checking the details on the blood bag and that of the patient	99.2%
5	Checking the blood bag for physical deterioration before transfusion	95.1%
6	Performing hand hygiene procedure before starting the blood transfusion	94.7%
7	Checking the vital status of the recipient every half an hour.	89.7%
8	Looking for signs and symptoms of adverse transfusion reactions	91%
9	Checking the vital status of the recipient after the completion of transfusion	96.5%
10	Proper disposal of blood bags	93.7%
11	Informing the blood bank staff in the event of adverse blood transfusion reaction	99.3%
12	Submitting appropriate blood samples of the recipient, to the blood in the event of adverse transfusion reaction	87.9%



**Fig. 1:** graphical representation of performance indicators of blood component administration before and after annual training for the staff nurses in transfusion procedures.

Series 1 = Performance indicators from June 2015 to May 2016.

Series 2 = performance indicators from June 2016 to May 2017

## Results

The sample consisted of 220 staff nurses who were directly associated with patient care in our hospital. They were posted in various departments where blood component transfusions were given frequently. The average age of a nurse was 35.8 years with maximum age being 58 and minimum age being 23 years, 86.8% of the staff nurses were females. And 13.18 % of staff nurses were male. The total numbers of blood component transfusion done between May 2015 to June 2016 were 2,482, and the average blood transfusion conducted by each staff nurse was 11.2 per month. The maximum number of transfusion conducted by a single staff nurse was 29 and the minimum is 0.

It is noteworthy that the highest percentage of staff nurses fell into category of 2 to 5 years of experience.

Part B of the questionnaire was further divided into four categories, i.e., questions based on blood bag storage details, pre transfusion steps, transfusion steps and post transfusion steps. Total numbers of staff nurses who had answered the

questions correctly in each of the four categories were analysed, according to their years of experience.

In first set of questions, which were based on the blood bag storage details, maximum number of correct responses (72) was obtained for the question on volume of whole and minimum number of correct responses (18) was obtained for the question on volume of the platelets.

In the second set of questions which dealt with pre transfusion procedures, maximum correct responses (83) was obtained for samples required of cross matching and minimum correct response (9) was obtained for question in indication on premedication before the starting of transfusion.

In the third set of questions, which dealt with transfusion procedures, maximum correct responses (89) was obtained for question based of identification of mismatched transfusion and minimum correct response (12) for the question on adverse transfusion reaction with least incidence.

In the fourth set of questions, which dealt with post transfusion procedures, maximum correct response (79) was obtained for question on blood

bag disposal and minimum correct response (29) for question based on adverse transfusion reaction work up

Knowledge score was calculated based on the number of years of experience of the staff nurse. Knowledge scores were calculated by dividing the total number of correct responses given by each staff nurse and dividing it by the total number of questions (30) and converting the value into percentage.

The number of staff nurses whose knowledge score is less than 25 % is 151 (68.8%), between 25% to 50 % is 56 (25.45%) and more than 50% of the knowledge score is obtained only by 13 (5.90%) staff nurses. The average knowledge score of staff nurses with less than 2 years of experience was 16.60%, 2 to 5 years of experience was 17.21% and more than 5 years was 37.57% The knowledge score of the staff nurses who had more than 5 years of experience was better when compared to the other staff nurses, but still it is less 50%. This study clearly shows, the staff nurses knowledge in blood transfusion practices is insufficient.

After the result analysis of the above questionnaire based cross sectional observational study, the second part of this study was started. The key performance indicators involving the pre transfusion, transfusion and post transfusion steps were printed out in a checklist form [Table 11]. All the indicators were checked in the nurses' records in the case sheets of patients, who had been transfused with blood components, between June 2015 to May 2016. The results were obtained and tabulated in a spread sheet.

The Key performance indicators from June 2016 to May 2017 were monitored and the following results were obtained. Cumulative yearly data was obtained from monthly data.

## Discussion

The role of a staff nurse is very crucial in the blood component transfusion. The consultant usually decides for the need of blood transfusion and gives appropriate orders, which is executed successfully by the staff nurse. A staff nurse is expected to know all the details about the blood component transfusion procedures. Plenteous studies have already been done in above topic as to ascertain the knowledge, attitude and practices of the staff nurses in blood transfusion services and the results of such studies illustrated the deficient knowledge of the nursing staff and inappropriate

practises in blood transfusion [4,5]. Thus, the literature is abounding with multiple studies, investigating the nurses knowledge level in blood component transfusion and highlighting their inadequacies. Lack of knowledge of various aspects of blood transfusion by nursing staff, is a real threat to patient safety (Taylor et al. 2010). Bayraktar and Erdil showed insufficient knowledge about blood transfusion were reflected in undesirable practice [6]. In addition, in another study in Canada by Hardy on current status of transfusion triggers for red blood cell concentrates showed future research and development should focus on the determination of optimal transfusion strategies in various patient populations and on reliable monitors to guide transfusion therapy. Ingrandet al. in their experimental study on a stratified sample of 48 nurses showed that erroneous decisions occurred in 18.2% of the 576 blood compatibility tests per-formed at the bedside and showed this underscored the importance of continuing efforts to update theoretical and practical knowledge of nurses about this transfusion safety procedure.

In the first part of our study, we evaluated the knowledge score of the staff nurses in the four areas where the role played by a staff nurse is crucial, i.e., blood bag collection, pre transfusion procedures, transfusion procedures and post transfusion care of the patient. On an overall basis, 68.8% of the staff nurses had a knowledge score of less than 25 percentage. Next we tabulated the performance indicators of the blood component administration from June 2015 to May 2016. AABB has advocated, "Monitoring and assessment" as a tool for quality management system. Systematic assessments of performance indicators are done, to determine whether the actual activities comply with planned activities and if, they are implemented effectively. Performance indicators are designed to monitor, one or more operations, within a defined period of time. These Performance indicators reflect the degree of fulfilment of any defined set of operations as per the laid protocol.

Many studies have been conducted on the utilisation of blood components; by monitoring the cross match to utilisation ratio, rate of wastage of blood components, rate of expiration of blood bag units, transfusion index which portrays the efficiency of blood bag utilisation. A study by David et al. evaluates the various practice characteristics in 1,639 institutions across the USA. The authors have analyzed the CT ratio, RBC unit expiration rate, and RBC wastage rates in different institutions. A study by Memtombi et al. evaluates the CT ratio,

transfusion index, transfusion probability, RBC unit expiration rate, RBC unit wastage rate, packed RBC: whole blood ratio [8]. But not many studies have been conducted to analyse the knowledge of staff nurses in blood transfusion practices and its impact on the fulfilment of Key performance indicators of blood component administration.

The results of this, observational retrospective study, shows that there had been multiple episodes of contravention in implementing ethical techniques in the pre transfusion, transfusion and post transfusion period. The fulfilment percentage of each of the key performance indicators was found to be less than 30%, which was attributed to the lacunae in nurse's knowledge in blood components transfusion, endangering the lives of the blood component recipients. The issue was discussed in the Hospital Transfusion Committee meeting at our Centre, and prospective steps were taken to improve the transfusion practices in our Hospital.

In order to increase the knowledge and scientific practices in blood component transfusion, among the staff nurses, the following steps were undertaken in our hospital:

1. Short courses in blood transfusion procedures, which included lecture classes, practical sessions, pre test and post tests was developed and implemented. This short course was made mandatory for all the staff nurses of our hospital. It was also made a part of the induction course, for newly appointed staff nurses.
2. Nursing supervisors were identified in each floor of the hospital, and they were made responsible to teach the junior staff nurses.
3. Daily post transfusion rounds were undertaken from the blood bank, with check list of key performance indicators. The check list was verified with the case sheets of patients who received blood transfusion the previous day. The key performance indicators which were fulfilled and those which were not fulfilled were noted down for every blood component transfusion.
4. A booklet with all the important guidelines for ethical blood component transfusion was printed and issued to all the staff nurses.
5. Charts with Do's and Don'ts of blood transfusion was printed and displayed in all the wards.

Quality assurance in blood transfusion services is a continuous dynamic process. The above procedures are followed meticulously in

our hospital from June 2016 till date. The Key performance indicators from June 2016 to May 2017 were monitored and the following results were obtained. Cumulative yearly data was obtained from monthly data. The result of the performance indicators, after the training programme, displays a significant increment at all levels of the performance indicators. Continuous monitoring and periodical assessments of the performance indicators permits us to spot out exactly when and where things are going wrong, to substantiate the root cause of the problem and to formulate appropriate guideline or amendments in the process. The definitive intention of quality improvement is to facilitate us to accomplish excellent patient care by removing the deficiencies in processes, or services and by creating better teaching standards. These advancements must be based on data-driven analysis of the ongoing processes. Systematic assessments of the performance indicators of blood transfusion and analysis of the discrepancies, followed by effective implementation of methodical strategies to overcome the deficits, will ultimately enable the organisation to achieve higher standards of patients care in blood component transfusion.

## Conclusion

A strict process control should be adopted by various stake holders in blood transfusion services at various levels of blood banking operation, for an effective blood component transfusion, with utmost benefit to the patients. Performance indicators are indispensable tools, to monitor the quality of blood transfusion services from one vein to another. Monitoring of performance indicators is a proactive strategy, that assures continuous improvement in blood transfusion and thereby the patients care. Though multiple studies have been conducted to point out the lacunae in the knowledge about blood transfusion among the staff nurses who are the primary care providers, studies on improving their knowledge and practices have not been done so far. It becomes the responsibility of the individual organisations, to develop various teaching programmes, to tide over their deficiencies.

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