ANALYSIS OF BLOOD REQUIREMENTS AND BLOOD COLLECTIONS IN INDIA DURING THE YEAR 2016 – 2017 USING SPSS

Submitted by

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CHAPTER I

1. INTRODUCTION:

Blood is crucial for sustaining life as it performs vital functions in the body. Blood Transfusion Service (BTS) is a vital component of any health care delivery system. The timely availability of safe blood and blood products is essential in health facilities where transfusion is performed. Policy makers at different levels, programme managers and providers of blood for transfusion need to know how much blood is required for their population, where and when it is needed so that blood is neither under- nor oversupplied.

The national government is primarily responsible to ensure an adequate supply of safe blood and blood products and rational use. It is essential to establish a sustainable national blood system that should be supported by a national blood policy, strategic plan and appropriate legal instruments. Today, many countries including India face challenges in maintaining an adequate supply of safe blood and blood products and ensuring their appropriate use. This study deals with the analysis of blood requirements and blood collection in India.

1.2 CLINICAL DEMAND FOR BLOOD:

Clinical demand for blood is defined as the total number of units of whole blood and components requested/demanded to meet all blood transfusion for emergencies and elective procedures at a defined number of health facilities over a defined period of time (usually one year). The demand for blood in developing countries is to support acute haemorrhage during pregnancy-related complications, new-born care especially in pre-term infants, management of sepsis, haemorrhagic disease of the new-born, chronic anaemia, HIV related anaemia, micronutrient deficiencies etc

The demand for blood remains constant due to various medical procedures, surgeries, and treatments. According to WHO, blood donation by 1% of the population is generally taken as the minimum need to meet a nation's basic requirements for blood; while the requirements are higher in countries with more advanced health care systems (WHO 2009b). However, there is no evidentiary support or accessible statistical model to substantiate this hypothesis. As per the above norm, India's demand for blood is around 13.1 million blood units (1% of 1.3 billion population). Several studies and reports indicated varying amount of annual blood collection in India. In 2007, the total collection in India was reported as 4 million against the need of 10 million (WHO 2008). In 2011, it was reported that Indian blood banks were able to collect 5.5 million blood units against the requirement of 9 to 9.5 million per year.

1.3 COLLECTION OF BLOOD:

The collection of blood generally refers to the process of obtaining a blood sample from an individual for various purposes such as medical testing, transfusions or donations. This process typically involves using a sterile needle to draw blood from a vein.

Blood is collected by organising camps on different parts of the country. These camps are often set up in collaboration with health care organizations, blood banks, or non-profit agencies. The goal is to collect a significant amount of blood from donors to meet the demand for blood transfusions, medical treatments and emergencies. These events provide a convenient and accessible way for people to contribute to the blood supply and save lives.

`1.4 SUPPLY AND UTILIZATION OF BLOOD:

The supply of blood is the total number of units of whole blood and components supplied to healthcare facilities, against all requests/demand for blood transfusion over a defined period of time, usually taken as one year. The supply of blood is generally from licensed blood banks or blood storage centres across the country.

Ideally, a health care system should address 100% of demand for blood by ensuring uninterrupted supply within its catchment area. However, there exists a gap between clinical demand and supply due to the low volume of voluntary blood donation, lack of awareness, irrational demand, poor supply chain management system etc.

Utilization of blood is the total number whole blood units and components utilized by a defined number of healthcare facilities over a defined period, usually one year. There may be a gap between supply and utilization due to wastages, expiry, non-utilization in the health facilities.

1.5 OBJECTIVE OF THE STUDY:

To assess and analyze the dynamic relationship between blood requirements and blood collection across various states in India during 2016-2017. The project aims to identify patterns, discrepancies, and potential areas for improvement in the blood supply chain. By examining the data comprehensively, the goal is to provide actionable insights that can enhance the efficiency and effectiveness of blood collection and distribution processes, ultimately contributing to the optimization of healthcare resources and ensuring an adequate and timely supply of blood for medical needs throughout the country.

CHAPTER II

2. RESEARCH METHODOLOGY:

2.1 SOURCE OF DATA AND STUDY AREA:

The data used in this study is sourced from secondary sources, providing a comprehensive overview for the study and the study area is India.

2.2 RESEARCH TOOLS:

The collected data were processed with SPSS software. The following statistical tools were used in tune with the objective of the study.

2.2.1 MEASURES OF CENTRAL TENDENCY:

In statistics, a central tendency (or measure of central tendency) is a central or typical value for probability distribution. The most common measures of central tendency are the arithmetic mean, the median, and the mode. A middle tendency can be calculated for either a finite set of values or for a theoretical distribution, such as the normal distribution.

Formulas for Measures of Central Tendency:

Mean = $\sum xi/n$

Where,

$xi = x1+x2+...+ x\ n/n$

If n is odd,

Median = $x\ (n+1)/2$

If n is even,

Median = $x\ (n/2) + x\ ((n/2) + 1)/2$

Procedure To Calculate Measures Of Central Tendency In SPSS:

1. Go to variable view and enter the data.
2. Enter the corresponding data in data view.
3. Click Analyze → Descriptive statistics → Frequencies.
4. Dialog box appears. Click Blood requirements and Total blood collection to variables.
5. Click Statistics → Select Mean, Median, Mode

2.2.2 MEASURES OF DISPERSION:

1. STANDARD DEVIATION:

The standard deviation is a measure of the amount of variation of a random variable expected about its mean. Standard deviation may be abbreviated SD, and is most commonly represented in mathematical texts and equations by the lower case Greek letter σ (sigma), for the population standard deviation, or the Latin letter s, for the sample standard deviation.

2. COEFFICIENT OF VARIATION:

In probability theory and statistics, the coefficient of variation (CV), also known as Normalized Root-Mean-Square Deviation (NRMSD), Percent RMS, and relative standard deviation (RSD), is a standardized measure of dispersion of a probability distribution or frequency distribution.

Procedure To Calculate Measures Of Dispersion In SPSS:

- STANDARD DEVIATION:

1. Go to variable view and enter the data.
2. Enter the corresponding data in data view.
3. Click Analyze → Descriptive statistics → Frequencies.
4. Dialog box appears. Click Blood requirements and Total blood collection to variables.
5. Click Statistics → Select Standard deviation.

- COEFFICIENT OF VARIATION:

For independent variable,

1. In variable view enter the variable as ‘one’ and in data view enter the corresponding values 1.
2. Go to Analyze→ Descriptive statistics → Ratio.
3. Dialog box appears. Enter the Blood requirements to Numerator and one to Denominator→ Click Statistics.
4. Click Mean centered COV → Click continue and ok.

For dependent variable,

1. Click Transform → Compute variable → in target variable enter COV.
2. Function group → Statistical Functions and special variables → Cfvar
3. In numeric expression select blood requirements and total blood collection. Then click ok.

2.2.3 CORRELATION ANALYSIS:

Correlation Analysis is a statistical technique used to measure the magnitude of linear relationship between two variables. Correlation Analysis is not used in isolation to describe the relationship between variables. To analyze the relation between two variables, two prominent correlation coefficient are used –the Pearson product correlation coefficient and Spearman’s rank correlation coefficient .

In this study the Pearson product correlation coefficient is used to find the correlation coefficient between the significant difference of blood requirements and blood collections in India.This is also known as simple correlation coefficient and is denoted by “r”.

$$r= \sum(x_i-\bar{x})(y_i-\bar{y})/sqrt\ [\ \sum(x_i-\bar{x})^2 \sum (y_i-\bar{y})^2\ ]$$

Procedure for Finding Correlation Coefficient In SPSS:

1. Click on Analyze\Correlate\Bivariate.
2. Select your two variables and move them into the box Variables.
3. In the Correlation Coefficients section, Pearson is the default option. If you wish to request the Spearman rho, tick the Spearman box as well (or instead).
4. Under Options, click on the Exclude cases pair wise box.

5. Click on Continue, then OK.

2.2.6 KRUSKAL-WALLIS TEST

The Kruskal-Wallis H test (sometimes also called the "one-way ANOVA on ranks") is a rank-based nonparametric test that can be used to determine if there are statistically significant differences between two or more groups of an independent variable on a continuous or ordinal dependent variable. It is considered the nonparametric alternative to the one-way ANOVA, and an extension of the Mann-Whitney U test to allow the comparison of more than two independent groups.

Test Procedure in SPSS:

- SPSS Statistics has two different procedures that can be used to run a Kruskal-Wallis H test: the Legacy
- Dialogs > K Independent Samples procedure and the Nonparametric Tests > Independent Samples procedure.
- The procedure we set out below is the Legacy Dialogs > K Independent Samples procedure.
- We show you this procedure because it can be used with a wide range of versions of SPSS Statistics. However, it has the disadvantage of not automatically running post hoc tests. Therefore, we show you how to carry out the Nonparametric Tests > K
- Independent Samples procedure in our enhanced Kruskal-Wallis H test guide because it has the benefit of running posthoc tests, making the analysis procedure much quicker and easier.

HYPOTHESIS TESTING:

Null hypothesis (H_0):

There is no significant difference between blood requirements and blood collection in India.

Alternative hypothesis (H_1):

There is significant difference between blood requirements and blood collection in India.

LEVEL OF SIGNIFICANCE:

The level of significance α is 0.05.

DECISION CRITERIA:

If test value is greater than the level of significance ,then we accept null hypothesis(H0).

If test value is lesser than the level of significance ,then we reject null hypothesis(H1).

2.2.5 CHARTS:

Charts are visual representations of data, often in graphical form, designed to make complex information more understandable and accessible. Various types of charts exist, each suited to different types of data and purposes. Common types include bar charts, line charts, pie charts, and scatter plots. Charts help to convey trends, comparisons, and relationships within data, allowing viewers to grasp information quickly and effectively. In this study, we have effectively used line and bars charts to compare the blood requirements and blood collection.

Procedure To Draw Line and Bar Chart In SPSS:

1. Open your dataset in SPSS:

Load your dataset into SPSS that contains information on blood requirements and collection for each region.

2. Go to the “Graphs” menu:

Navigate to the “Graphs” menu at the top of the SPSS window.

3. Choose a chart type:

Depending on your data and the message you want to convey, select an appropriate chart type.

Line chart: Useful for showing trends over time.
Bar chart: Suitable for comparing values across regions.

4. Define variables:

Specify the variables you want to use for the chart. Choose the region variable for the X-axis and the blood requirements/collection variable for the Y-axis.

You can adjust colors, labels, titles, and legends to make your visualization clear and informative.

5. Preview and execute:
   Preview your chart to ensure it accurately represents your data. Once satisfied, execute the chart to generate the visual representation.

2.2.6 TIME SERIES ANALYSIS:

A time series is a collection of observations of well-defined data items obtained through repeated measurements over time **.**
To forecast or predict the future value over a period of time. The word forecast means to estimate or predict. It entails developing models based on previous data and applying them to make observations and gudie future strategic decisions.
It has tons of practical applications including : weather forecasting , economic forecasting , healthcare forecasting , climate forecasting , engineer forecasting , finance forecasting , retail forecasting , business forecasting , environmental studies forecasting , social studies forecasting and more .

Procedure to Forecast In SPSS:

1. Go to variable view and enter the data.
2. Enter the corresponding data in data view.
3. Click analyze → forecasting → create models.
4. Dialogue box appear. Dependent variable as blood_requirement and Independent variable as total_blood_collection and method as export modeler. 5.
5. Click ok.

CHAPTER III

3 ANALYSIS AND INTERPRETATIONS:

3.1 AVERAGE AMOUNT OF BLOOD REQUIRED AND BLOOD COLLECTED:

The following table represents the average amount of blood units required and collected in India during the years 2016-2017.

Statistics			
		BLOOD REQUIREMENTS	TOTAL BLOOD COLLECTION
N	Valid	36	36
	Missing	0	0
Mean		362701.91	308170.69
Median		220200.00	164190.50
Std. Deviation		477750.73	370757.79

Inference:

In India on an average 362701.91 units of blood are needed during the years 2016-2017 but only 308170.69 units of blood are collected, from this we can clearly say that the collection of blood is less than the requirement.

3.2 RATIO STATISTICS FOR BLOOD REQUIREMENT AND COLLECTION:

The following table shows the coefficient of variation between blood requirements and blood collection i.e., the dispersion level around the mean in India during the year 2016-2017.

STATES / UTs	BLOOD REQUIREMENTS	TOTAL BLOOD COLLECTION	COV
Andaman and Nicobar Islands	3799	2204	0.38
Andhra Pradesh	846655	459852	0.42
Arunachal Pradesh	13826	5355	0.62
Assam	311693	220000	0.24
Bihar	1167257	182242	1.03
Chandigarh	10547	84955	1.1
Chhattisgarh	255402	163756	0.31
Dasra and Nagar Haveli	3429	8286	0.59
Daman and Diu	2429	1735	0.24
Delhi	186869	546990	0.69
Goa	14577	18403	0.16
Gujarat	603836	798997	0.2
Haryana	253531	270860	0.05
Himachal Pradesh	71232	38540	0.42
Jammu and Kashmir	125489	63011	0.47
Jharkhand	329662	164625	0.47
Karnataka	611307	960049	0.31
Kerala	333877	386686	0.1
Lakshadweep	644	0	1.41
Madhya Pradesh	725976	454310	0.33
Maharashtra	1213621	1460050	0.13
Manipur	27218	22602	0.13
Meghalaya	29640	14262	0.5
Mizoram	10910	23593	0.52
Nagaland	19806	10713	0.42
Odisha	419474	401958	0.03
Puducherry	12445	21591	0.38
Punjab	277041	383198	0.23
Rajasthan	74791	582255	0.18
Sikkim	6077	5618	0.06
Tamil Nadu	778815	885820	0.09
Telangana	351940	395723	0.08
Tirpura	36710	28708	0.17
Uttar Pradesh	2238974	862059	0.63
Uttarkhand	101168	115520	0.09
West Bengal	913477	1049619	0.1
India	13057269	11094145	0.11

Ratio Statistics for BLOOD REQUIREMENTS / ONE
Coefficient of Variation
Mean Centered
131.72%

Ratio Statistics for TOTAL BLOOD COLLECTION / ONE
Coefficient of Variation
Mean Centered
120.31%

Inference:

The above table show that the mean centered for blood requirements is 131.72% and for blood collection is 120.31%.

3.3 CORRELATION BETWEEN BLOOD REQUIREMENTS AND BLOOD COLLECTIONS DURING THE YEAR 2016:

The following table shows the correlation between blood requirements and total blood collection.

Null hypothesis (H_0):

There is no significant difference between blood requirements and blood collection in India.

Alternative hypothesis (H_1):

There is significant difference between blood requirements and blood collection in India.

Correlations

		V2	V3
V2	Pearson Correlation	1	.753**
	Sig. (2-tailed)		.000
	N	36	36
V3	Pearson Correlation	.753**	1
	Sig. (2-tailed)	.000	
	N	36	36

**. Correlation is significant at the 0.01 level (2-tailed).

Inference:

The correlation coefficient is 0.753. The p value is 0.00 is lesser than 0.05 then we reject H_0. Hence, there is significant difference between blood requirements and blood collections.

3.4 HYPOTHESIS TESTING BETWEEN BLOOD REQUIREMENTS AND BLOOD COLLECTIONS:

Null hypothesis (H_0):

There is no significant difference between blood requirements and blood collection in India.

Alternative hypothesis (H_1):

There is significant difference between blood requirements and blood collection in India.

Level Of Significance:

The level of significance α is 0.05.

Kruskal-Wallis Test

Ranks

	RC	N	Mean Rank
V2	REQUIREMENTS	37	37.92
	COLLECTION	37	37.08
	Total	74	

Test Statistics[a,b]

	V2
Chi-Square	.028
df	1
Asymp. Sig.	.867

a. Kruskal Wallis Test

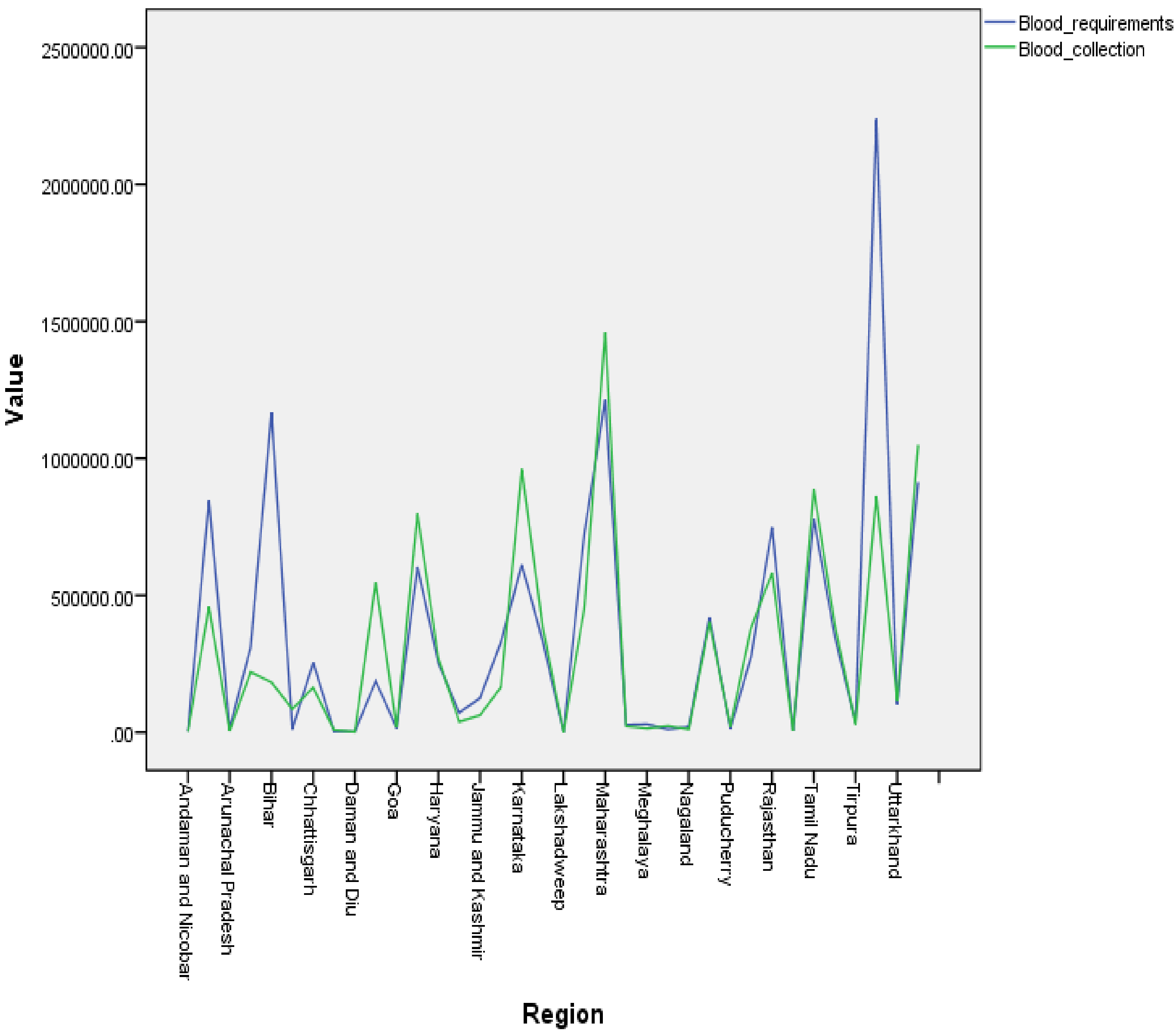
b. Grouping Variable: RC

Inference:

Then p value is 0.867 It is greater than the level of significance i.e., 0.05. So, we accept H_0. Hence, there is no significant difference between blood requirements and blood collections.

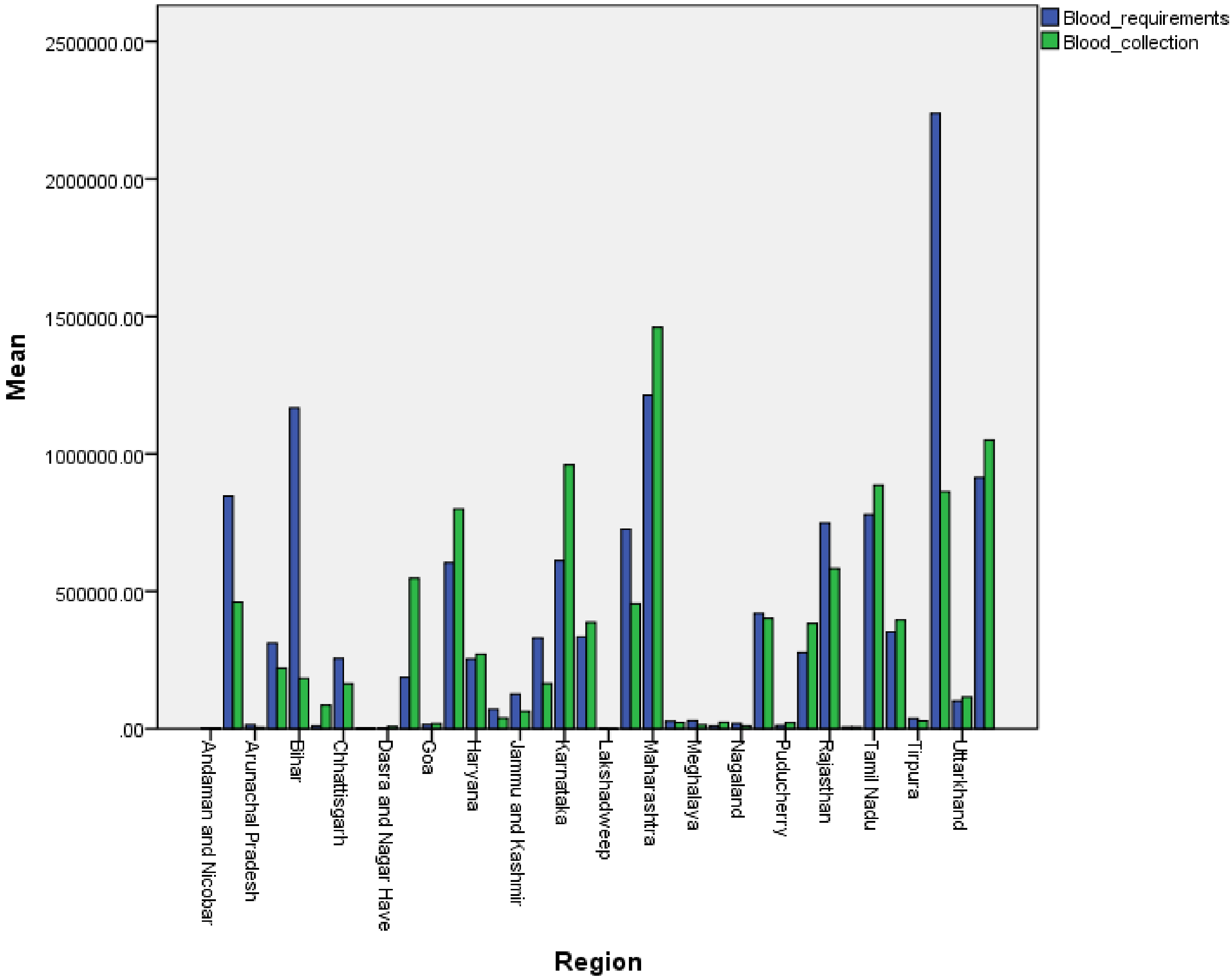
3.5 COMPARISON BETWEEN BLOOD REQUIREMENTS AND BLOOD COLLECTIONS DURING THE YEAR 2016 – 2017 USING LINE CHART

The following line chart shows the comparison between blood requirements and blood collections during the year 2016 – 2017.



COMPARISON BETWEEN BLOOD REQUIREMENTS AND BLOOD COLLECTIONS DURING THE YEAR 2016 – 2017 USING CLUSTERED BAR CHART:

The following bar chart shows the comparison between blood requirements and blood collections during the year 2016 – 2017.



Inference:

From these charts we clearly infer that the Blood requirements for the year 2016-2017 are higher than the Blood Collection during the same year. To increase the availability of the Blood we should create more awareness about the value of the Blood. It is also necessary to make more blood banks across the states.

3.6 ESTIMATION OF BLOOD REQUIREMENTS AND BLOOD COLLECTIONS DURING THE YEAR 2016 – 2017:

The following tables show the time series analysis for the different states in India during the year 2016-2017.

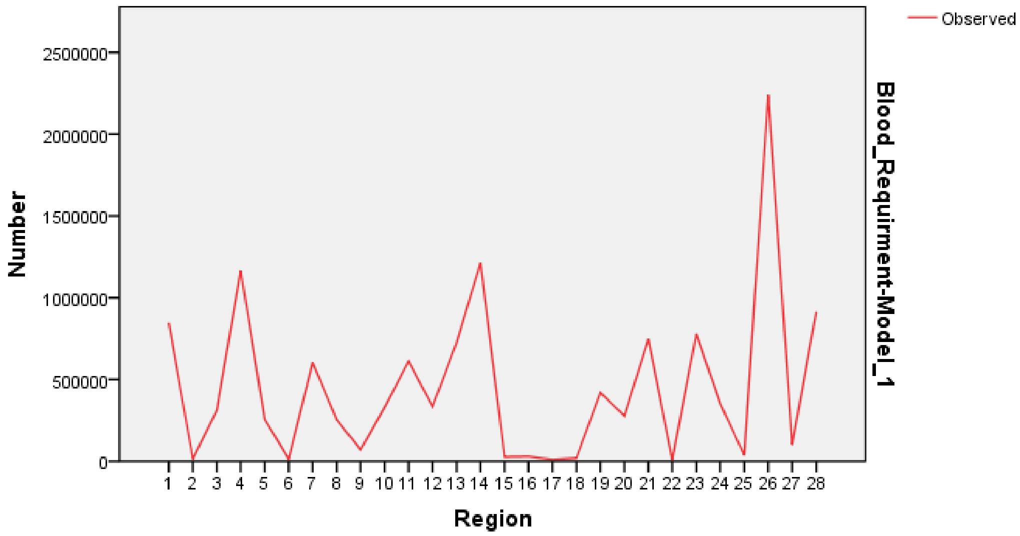
Time Series Modeler: STATE

Model Description			
			Model Type
Model ID	Blood_Requirment	Model_1	ARIMA(0,0,0)

Model Summary

Model Fit											
Fit Statistic	Mean	SE	Minimum	Maximum	Percentile						
					5	10	25	50	75	90	95
Stationary R-squared	.492	.	.492	.492	.492	.492	.492	.492	.492	.492	.492
R-squared	.492	.	.492	.492	.492	.492	.492	.492	.492	.492	.492
RMSE	389046.883	.	389046.883	389046.883	389046.883	389046.883	389046.883	389046.883	389046.883	389046.883	389046.883
MAPE	437.771	.	437.771	437.771	437.771	437.771	437.771	437.771	437.771	437.771	437.771
MaxAPE	3940.072	.	3940.072	3940.072	3940.072	3940.072	3940.072	3940.072	3940.072	3940.072	3940.072
MAE	277251.148	.	277251.148	277251.148	277251.148	277251.148	277251.148	277251.148	277251.148	277251.148	277251.148
MaxAE	958311.228	.	958311.228	958311.228	958311.228	958311.228	958311.228	958311.228	958311.228	958311.228	958311.228
Normalized BIC	26.244	.	26.244	26.244	26.244	26.244	26.244	26.244	26.244	26.244	26.244

Model Statistics						
Model	Number of Predictors	Model Fit statistics	Ljung-Box Q(18)			Number of Outliers
		Stationary R-squared	Statistics	DF	Sig.	
Blood_Requirment-Model_1	1	.492	11.828	18	.856	0



Time Series Modeler : UNION TERRITORIES

The following tables show the time series analysis for the union territories in India during the year 2016-2017.

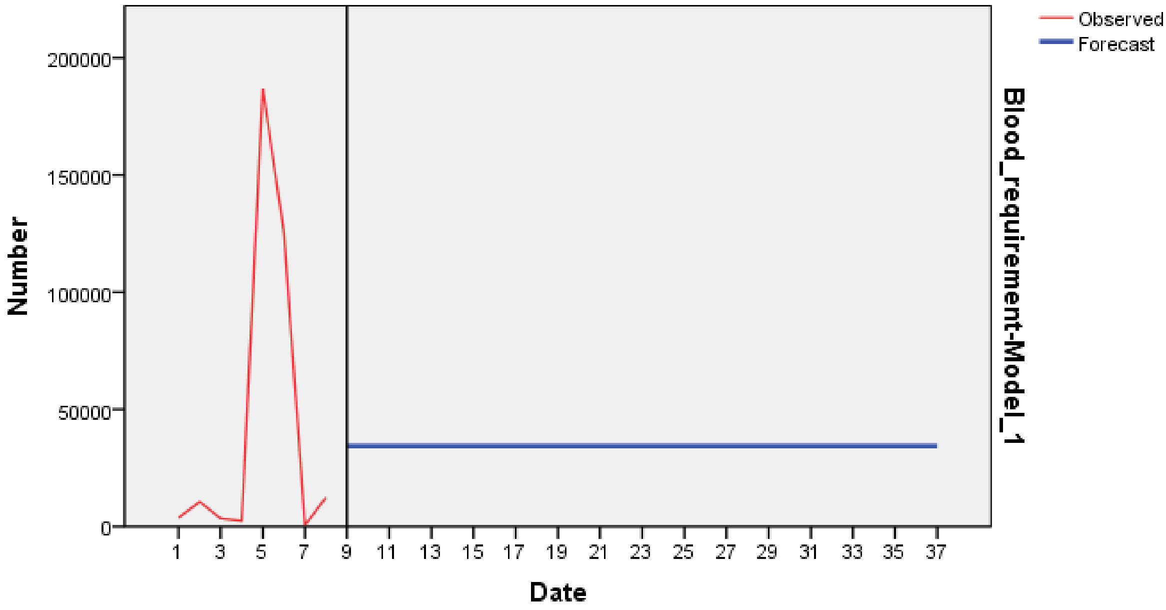
Model Description			
			Model Type
Model ID	Blood_requirement	Model_1	Simple

Model Summary

Model Fit											
Fit Statistic	Mean	SE	Minimum	Maximum	Percentile						
					5	10	25	50	75	90	95
Stationary R-squared	.262	.	.262	.262	.262	.262	.262	.262	.262	.262	.262
R-squared	-.110	.	-.110	-.110	-.110	-.110	-.110	-.110	-.110	-.110	-.110
RMSE	75600.896	.	75600.896	75600.896	75600.896	75600.896	75600.896	75600.896	75600.896	75600.896	75600.896
MAPE	1038.484	.	1038.484	1038.484	1038.484	1038.484	1038.484	1038.484	1038.484	1038.484	1038.484
MaxAPE	5941.175	.	5941.175	5941.175	5941.175	5941.175	5941.175	5941.175	5941.175	5941.175	5941.175
MAE	49320.771	.	49320.771	49320.771	49320.771	49320.771	49320.771	49320.771	49320.771	49320.771	49320.771
MaxAE	167079.045	.	167079.045	167079.045	167079.045	167079.045	167079.045	167079.045	167079.045	167079.045	167079.045
Normalized BIC	22.726	.	22.726	22.726	22.726	22.726	22.726	22.726	22.726	22.726	22.726

Model Statistics

Model	Number of Predictors	Model Fit statistics	Ljung-Box Q(18)			Number of Outliers
		Stationary R-squared	Statistics	DF	Sig.	
Blood_requirement-Model_1	0	.262	.	0	.	0



Inference:

From the above two graph we infer that the trend line is depending upon the region. The model fit table provides fit statistics calculated across all models. It provides a concise summary of how well the models fit with the re-estimated parameters. From the graph of states, we see that the significance value is more than 0.05. So there is no degree of risk if we are willing to accept the given data. Likewise from the union territories, we see that the significance value is 0 which is less than 0.05. So there is a degree of risk if we are willing to accept the given data.

CHAPTER IV

4. CONCLUSION:

Human lives are precious and blood is a significant elixir for our life. From the study, we infer that blood collection availability of blood in different region is not even. There is a uneven distribution of blood collection and insufficiency, so to increase and to make efficient use of the blood availability we have to assign blood banks at regions where there is high demand of blood, as blood collection is crucial for various medical purposes. Additionally, blood donation is vital for saving lives through transfusions, so one main step that we all can take to increase the blood collection is to create awareness among the people about the importance of blood donation. We hope this project brings a clear insight of the collection of bloods and the uses of its availability in different regions in future.

CHAPTER V

5. REFERENCES

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