

ANALYSIS OF TEMPERATURE DEVIATIONS IN STORAGE OF RED CELLS

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INTRODUCTION

- Safe storage of blood is an integral component for blood safety.
- Blood must be stored in equipment that meets defined standards of performance and by staff who follow established procedures at all times.
- The blood bank refrigerator is the basic requirement for any blood bank.

INTRODUCTION

- Whole blood and packed red cells are stored in a Blood Bank Refrigerator (B.B.R) at temperature between 2 to 6⁰ C with set temperature of 4⁰ C.
- Any deviations from the desired temperature will result in the red cells unsuitable for issue and transfusion.

INTRODUCTION

- These B.B.R have their own Digital temperature display with 0.1 °C graduation ,visual and audible alarm system indicating variation in temperatures and two temperature sensors with automatic door locks.
- Temperature recording device such as thermograph and temperature monitor chart are used for constant monitoring of temperature.

AIM & OBJECTIVES

- The study was conducted to monitor and analyze temperature deviations in storage of red cells in blood bank refrigerator (B.B.R).
- To compare the temperature recording chart and thermograph in identifying deviations.
- Steps to prevent the reoccurrence of temperature deviations.

MATERIALS AND METHODS

- This study was conducted in Department of Transfusion Medicine, The Tamilnadu Dr.M.G.R Medical University, Chennai
- Time period – January 2015 to May 2016.
- Thermograph and temperature chart were analysed and deviations of over 5° C or less than 3° C from the standard temperature of 4° C in B.B.R were recorded.

MATERIALS AND METHODS

- . Each individual day was separated into four quadrants based on the graphic representation in the thermograph.
- 12.00 A.M – 6.00 A.M (1st Quadrant)
- 6.00 A.M – 12.00 Noon (2nd Quadrant)
- 12.00 Noon – 6.00 P.M (3rd Quadrant)
- 6.00 P.M – 12.00 A.M (4th Quadrant)

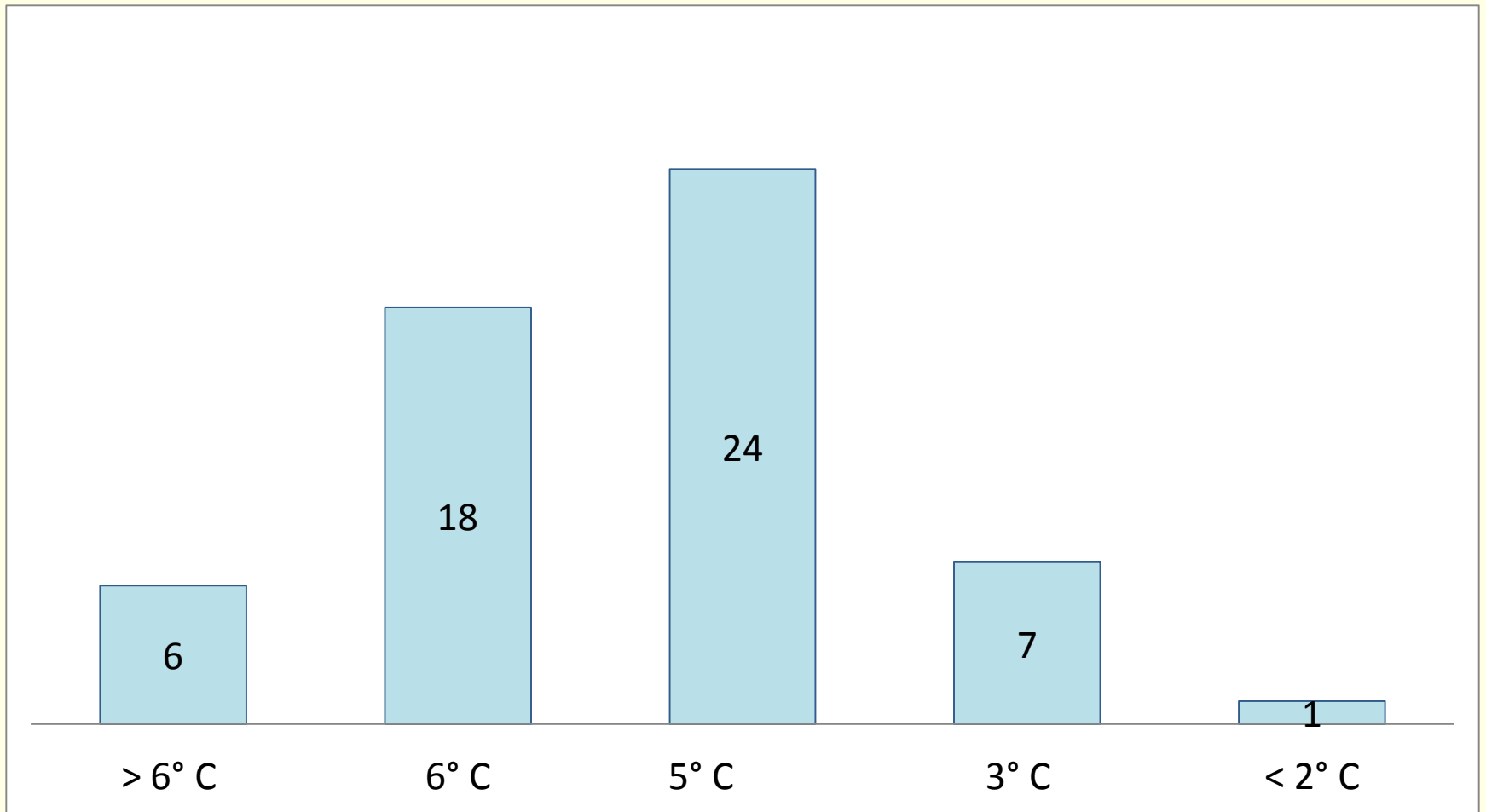
Temperature chart

- Our temperature maintenance record chart was split into around 4 hour duration.
- 7 A.M , 12 Noon , 4 P.M & 8 P.M.
- It was duly signed by technician who is on the duty.
- Signed daily by the Medical Officer.
- Pasted over the B.B.R.

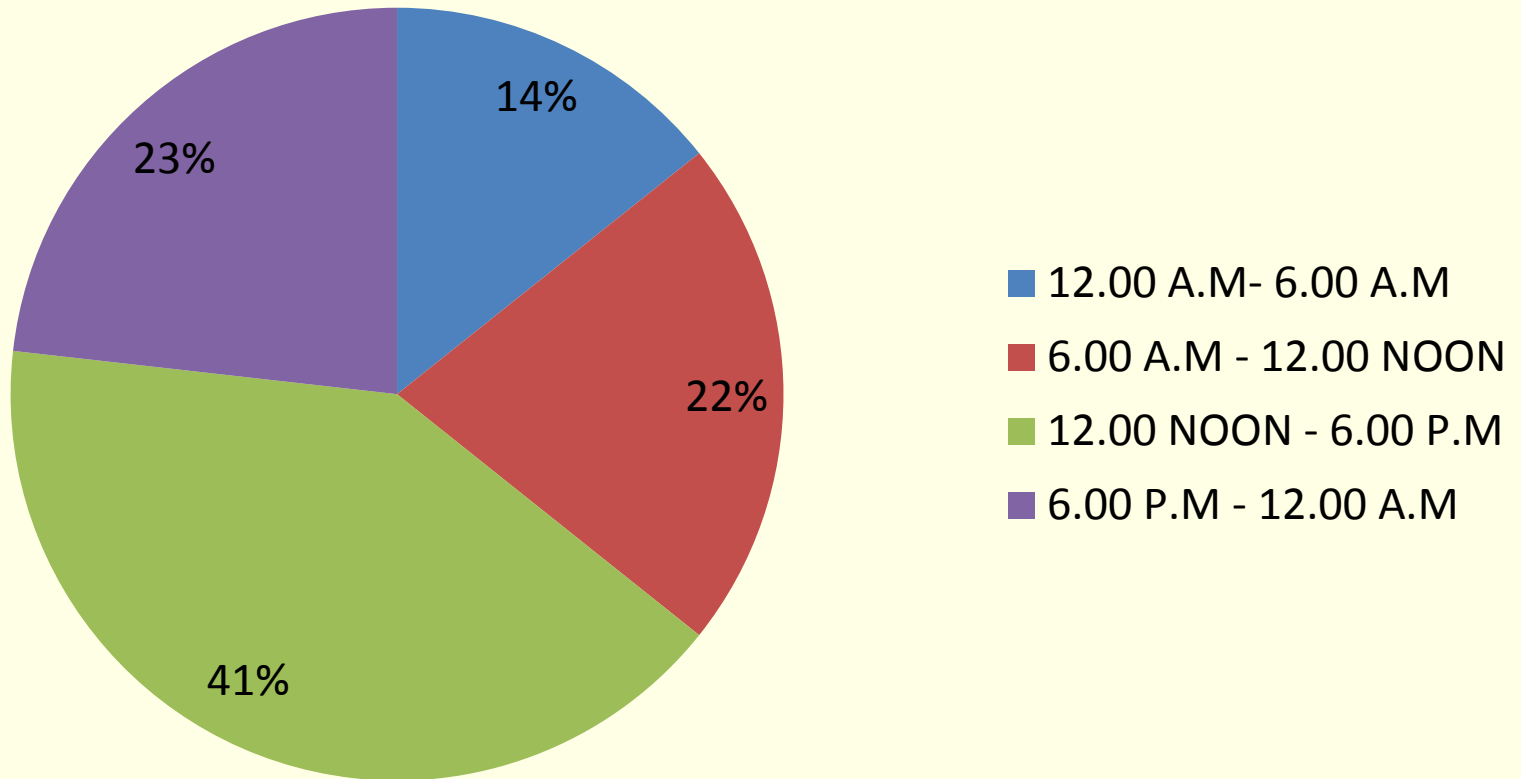
RESULTS

- The total number of deviations occurred were fifty six.
- There was an even distribution of the number of deviations in each month.
- Increase of temperature of over 5⁰ C from 4⁰ C were more common (42 %) than the other deviations observed.

TEMPERATURE DEVIATIONS



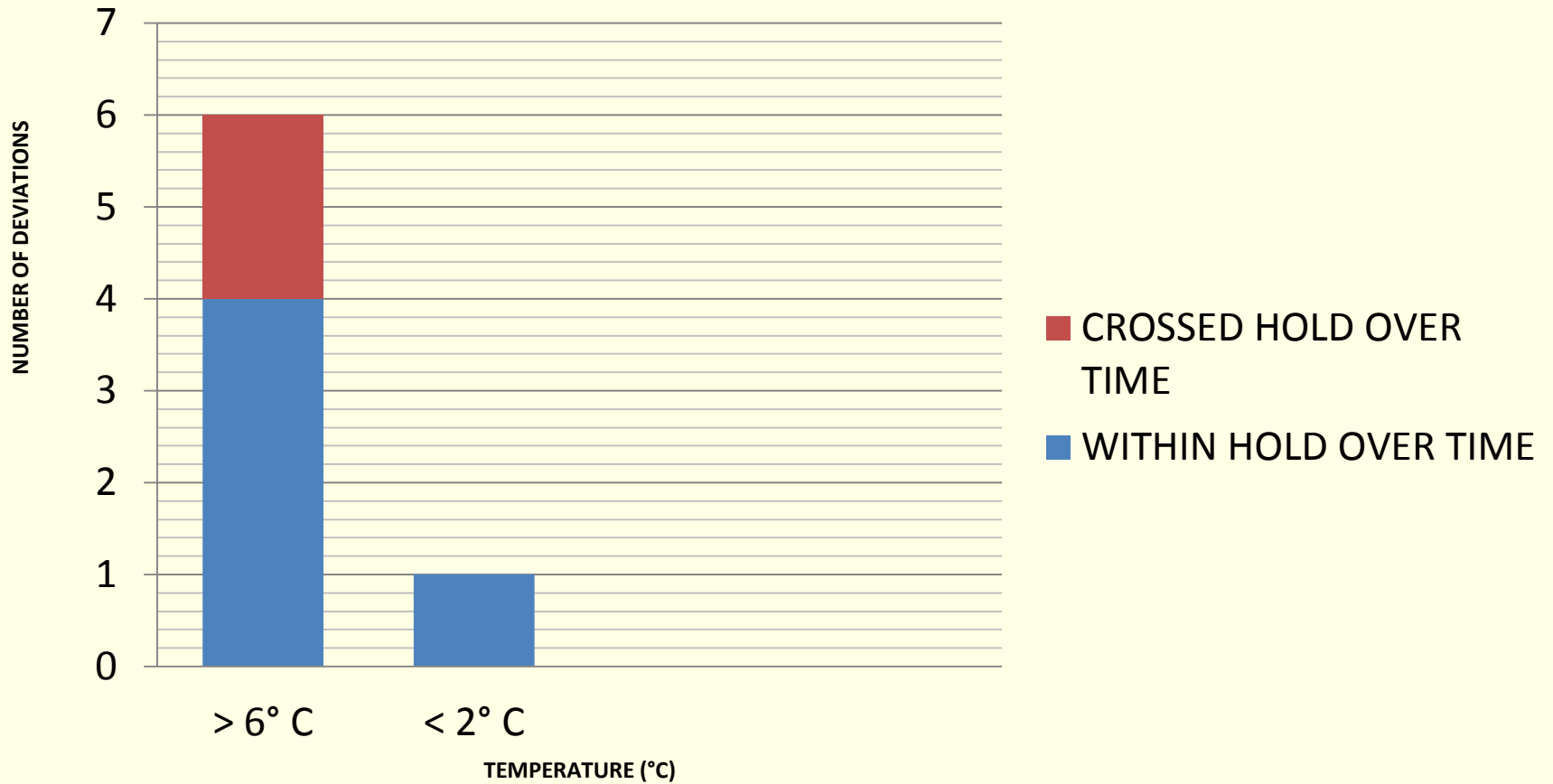
Temperature Deviations based on Time Period



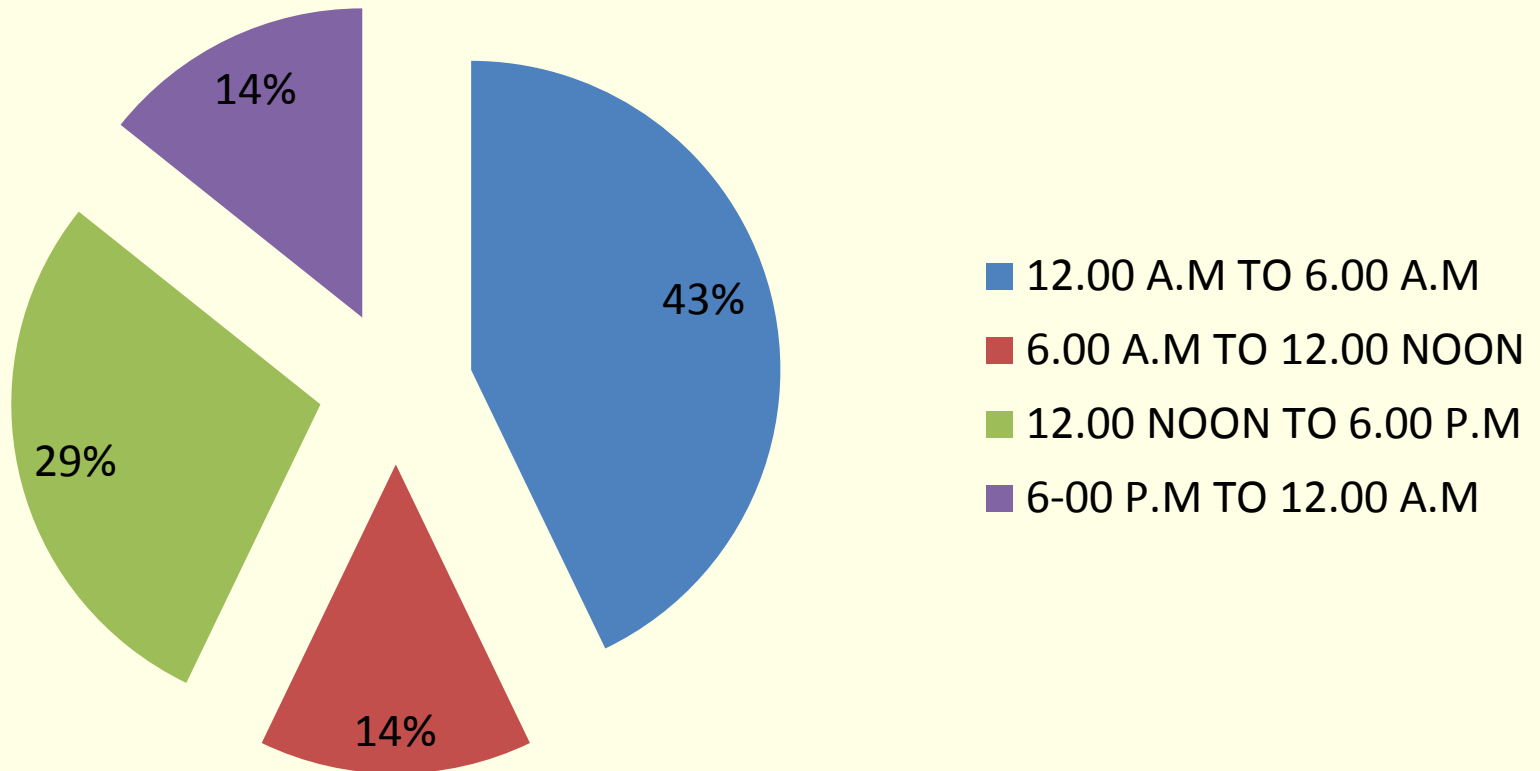
UNSAFE DEVIATIONS

- SIX instances of temperature rising clearly over 6⁰ C and ONE occurrence of temperature falling less than 2⁰ C .
- TWO instances of deviations in the temperature (more than 6⁰ C) crossing the hold over time (30 minutes).
- Hold over time is the length of time that the B.B.R can maintain the temperature of blood within acceptable limits when there is an power failure.

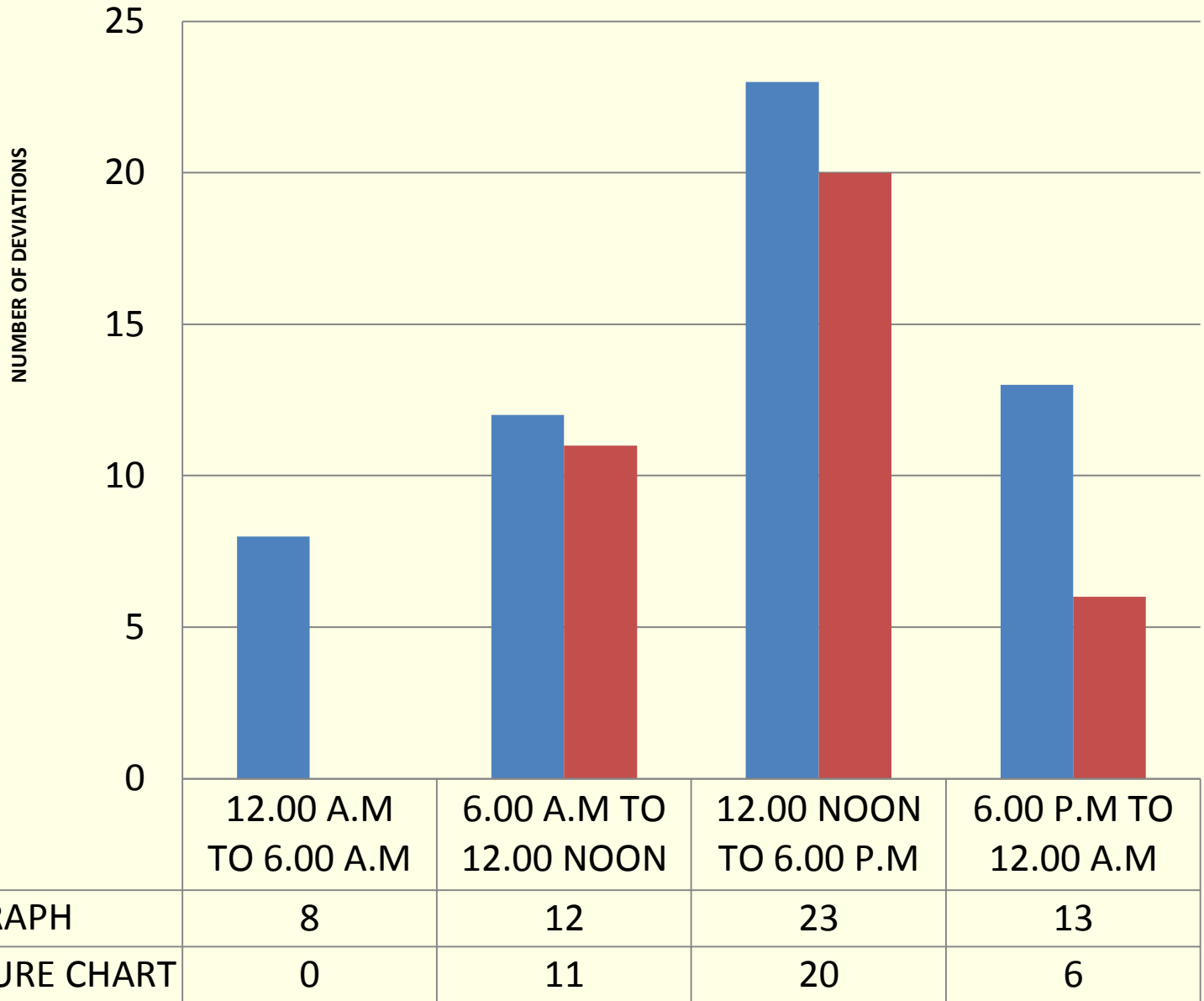
UNSAFE DEVIATIONS



Unsafe Deviations in Relation with Time period



Thermograph & Temperature chart



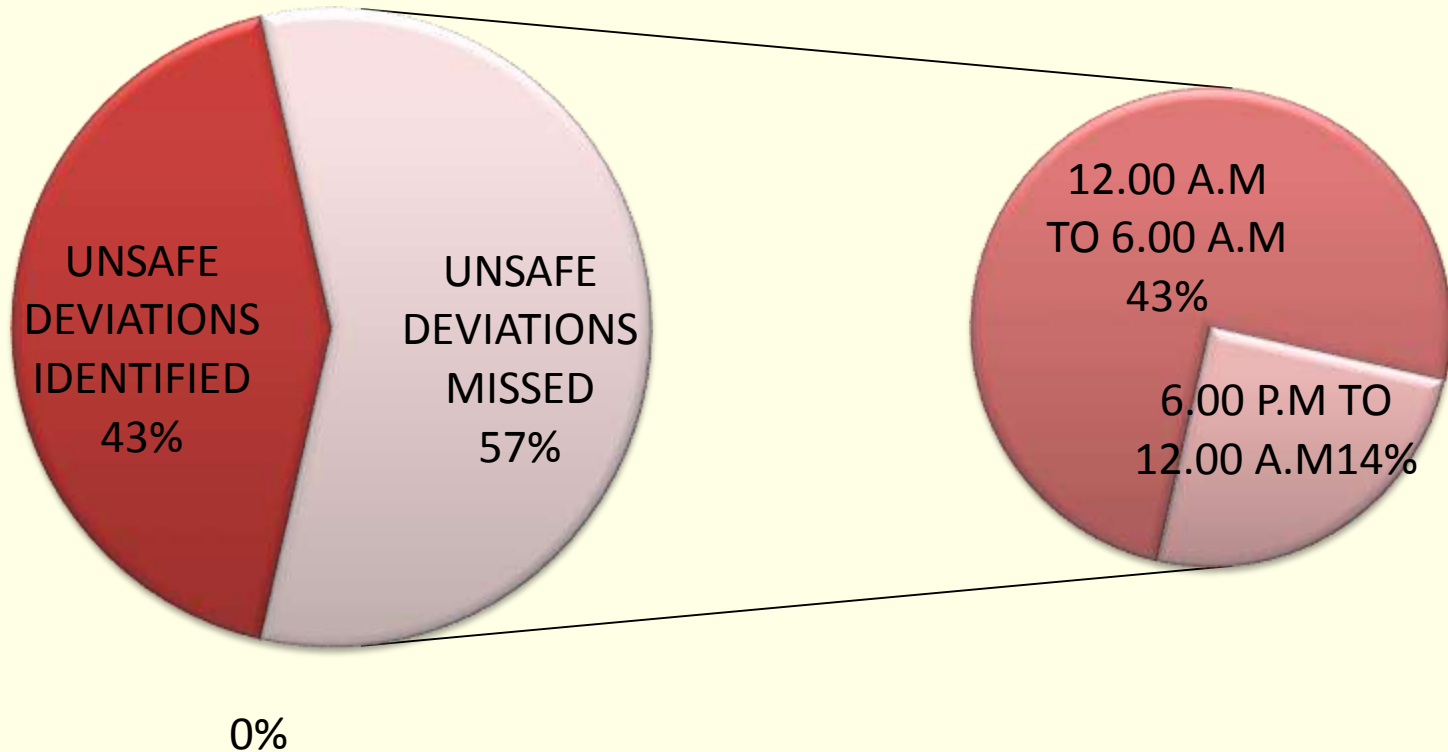
DISCUSSION

- If the red cells are not maintained in the desired temperature (2 to 6°C) there is a risk of damage to the red cells and bacterial contamination in the blood bags.
- Our study reveals the most common temperature fluctuation were 1⁰ C more than the standard 4⁰ C.

Performance of temperature chart

- 57 % of deviations were not recorded in the temperature chart.
- This is mainly due to interval between recording the temperatures. (4 hours duration).
- Most commonly missed during the NIGHT. (6.00 P.M – 6.00 A.M).
- Though corrective action was taken if hold over time was crossed, it was not documented in the temperature chart.

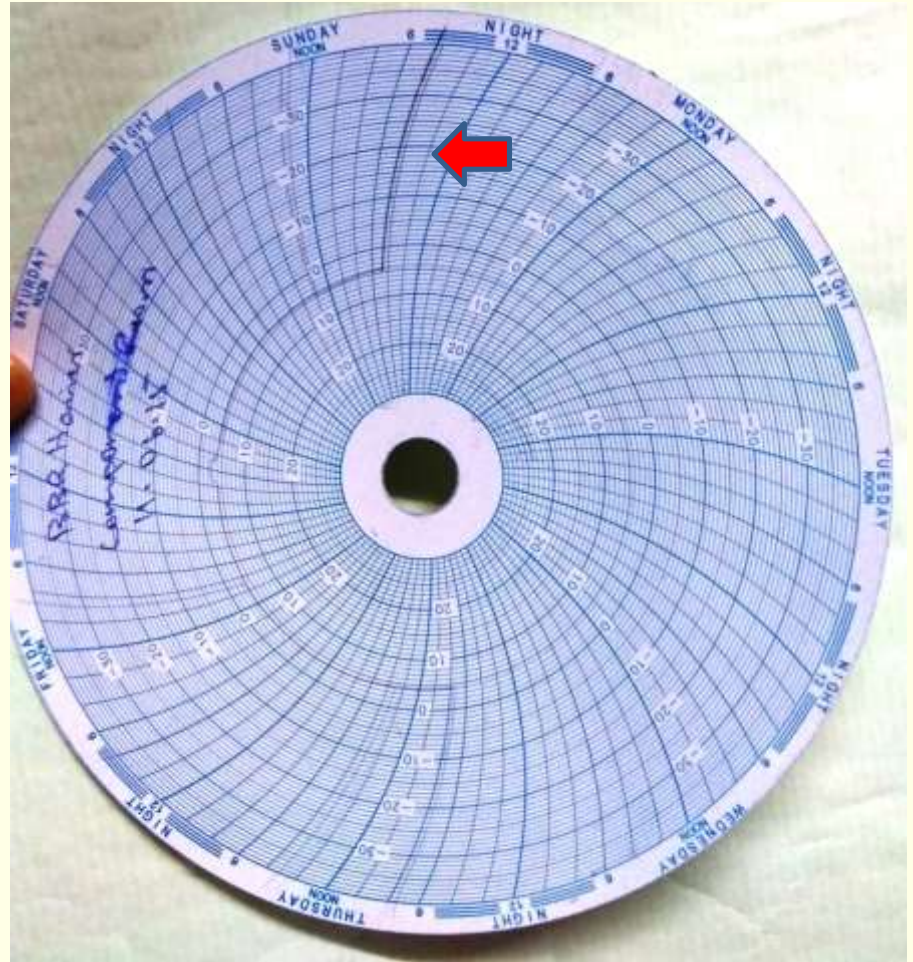
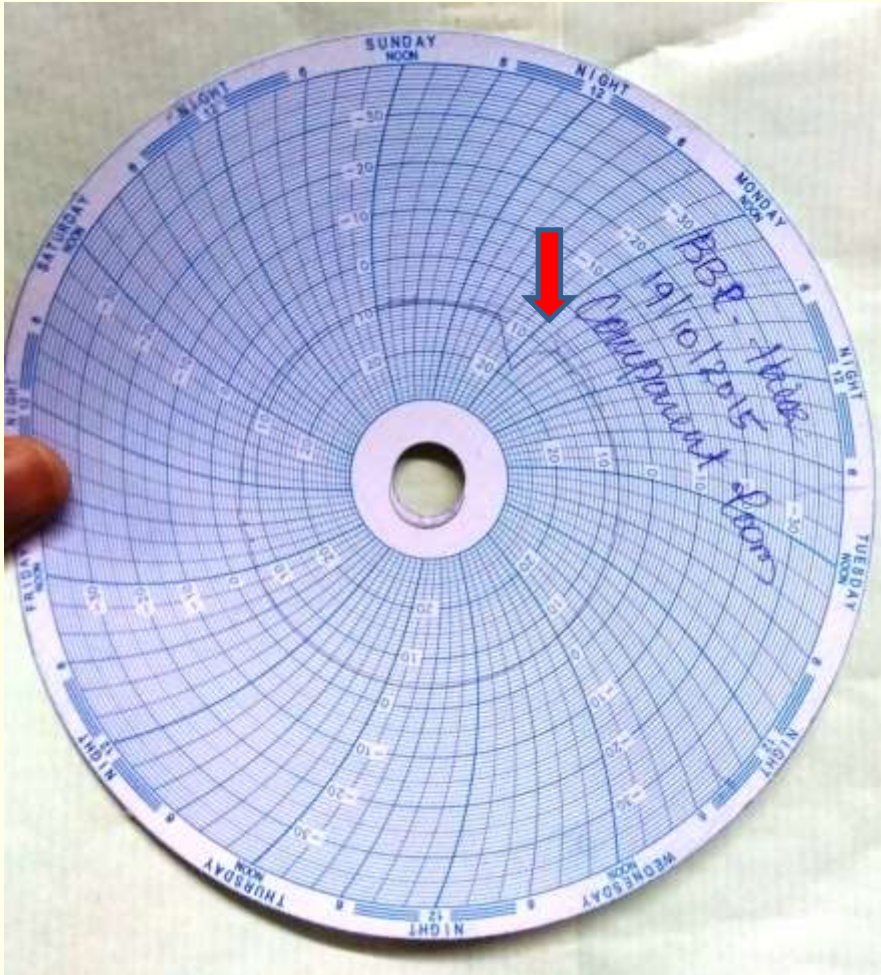
Unsafe Deviations identified and missed in Temperature chart in relation with Time period



Performance of Thermograph

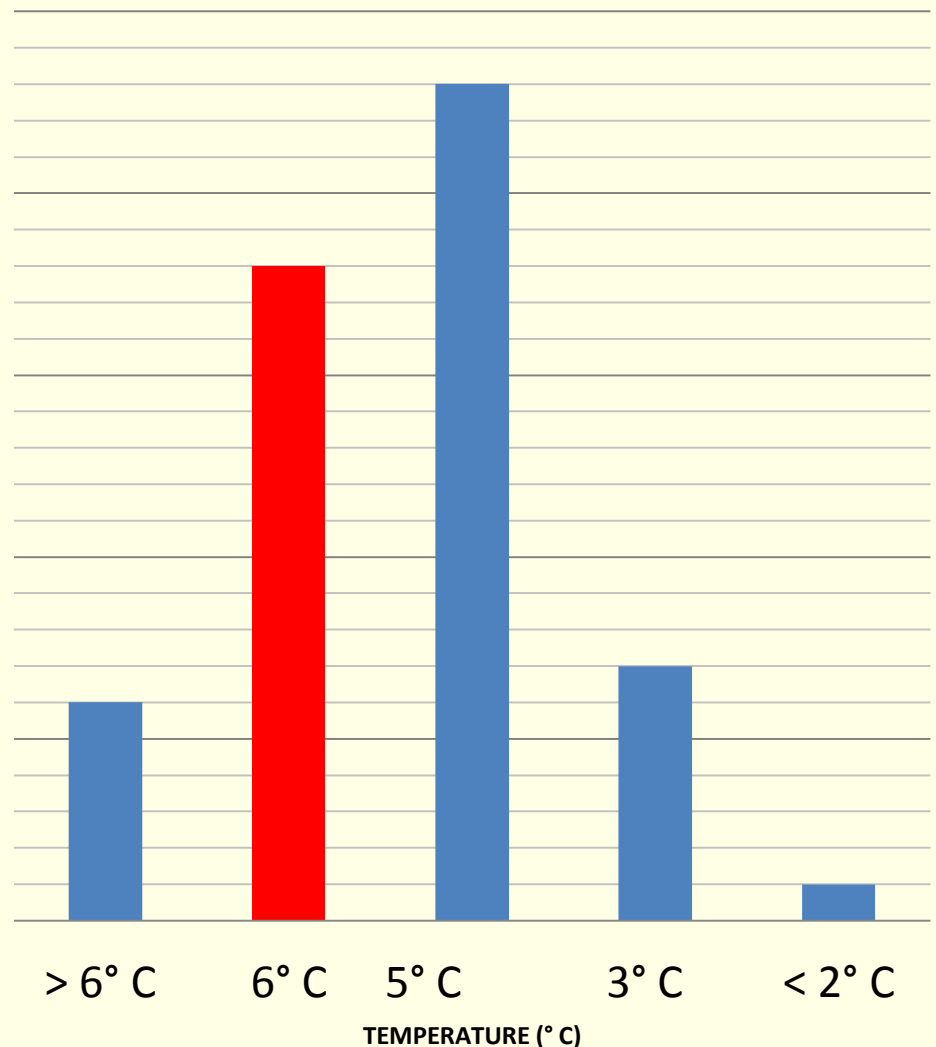
- Thermograph remains a reliable documentation of temperature deviations over temperature chart.
- The disadvantage of thermograph is the ink marker is too feeble to identify deviations.
- Wrong handling and placing of the thermograph in B.B.R gives false positive deviations.

False deviations in Thermograph



HIGH RISK DEVIATIONS

- Deviations around 6° C need to be carefully monitored
- B.B.R kept open for longer periods for stock verification, storing new blood units after blood camps are the probable reasons.



MEASURES TAKEN AFTER UNSAFE DEVIATIONS CROSSING HOLD OVER TIME

- Blood bags were immediately shifted to another B.B.R.
- Blood culture were done randomly in blood units to identify bacterial contamination which was negative.
- plasma hemoglobin was calculated and hemolysis was found within permissible limits.

Unsafe Deviations – How to correct them?

- 43 % of unsafe deviations occurring during the early hours. (12.00 A.M – 6.00 A.M)
- Careful monitoring by the duty technician and in case of any fault in power, prompt secondary back up measures must be taken (alternate power supply).
- Spare B.B.R available to shift blood bags in case of emergency.
- Report to service engineer and identify the cause.

Maintenance and Calibration of Blood Bank Refrigerator

DAILY CHECKS

- Temperature display
- Thermograph assembly
- Cleanliness
- Manual recording of temperature (12times in a day) .

WEEKLY CHECK

Internal temperature of refrigerator with external calibrated digital thermometer.

- Temperature probe of Refrigerator is properly placed in 10% glycerol solution.
- Alarms (Door ajar, Power failure alarm and temperature high and low alarm)
- Change the thermograph regularly.
- All the shelves should be cleaned with 10% vol/vol Ecosheild(Hydrogen peroxide solution)

SIX MONTHLY CHECK

- Preventive maintenance visit of service engineer
- **ANNUAL MAINTENANCE CONTRACT**
 - Regular service and maintenance after the warranty period.
 - Suppliers contact details and emergency telephone number made available in Blood Bank.
 - voltage fluctuations which can be avoided by installing a voltage regulator on the power lines that supply the blood bank refrigerator.

CONCLUSION

- Safe storage of blood is a vital link in the blood transfusion services.
- Regular service and maintenance of B.B.R is utmost importance for safe storage of red cells.
- Thermograph plays a important role over temperature chart in identifying and recording deviations.
- Extra care should be taken during the night time by duty staff in monitoring temperature deviations.

REFERENCES

- The Blood Cold Chain. WHO. Geneva.
- Joint United Kingdom Blood Transfusion Services and National Institute for Biological Standards and Control Professional Advisory Committee.
- NACO guidelines. Division of Blood Transfusion Services. Ministry of Health & Family Welfare.

T H A N K

Y O U