Efficiency of Central Sterile Supplies Department of A Multi-Speciality Hospital

By

Neelam Meena

Dissertation submitted for the partial fulfillment of the

MBA Hospital and Health Management

Academic year, 2015-2017

The IIHMR University, Jaipur

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INSTITUTE OF HEALTH
MANAGEMENT RESEARCH
(WHO Collaborating Centre for District Health System Based on Primary Health Care)

IIHMR UNIVERSITY

To whomsoever it may concern

This is to certify that **Dr Neelam Meena** student of MBA Hospital and Health Management from The IIHMR University, Jaipur has undergone internship training at **Manipal Hospital, Jaipur** from **6th February 2017** to **6th May 2017.**

The Candidate has successfully carried out the study designated to her during internship training and her approach to the study has been sincere, scientific and analytical.

The Internship is in fulfillment of the course requirements.

I wish her all success in all her future endeavors.

Dean, Academics and Student Affairs
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ManipalHospitals
LIFE'S ON

SMH/HR/2017/ECR00230

Date: 12th May 2017

TO WHOMSOEVER IT MAY CONCERN

This is to certify that, Dr. Neelam Meena, a student of IIHMR has undergone her internship project with us from 6th Feb 2017 to 6th May 2017.

During this period, he/she was involved in projects pertaining to "Efficiency of central Sterile supplies department" At "Manipal Hospital (Jaipur) Pvt. Ltd.

Her performance on the projects assigned and her conduct was found to be good.
We wish her success in her future endeavors.

For Manipal Hospital (Jaipur) Pvt. Ltd.

Manipal Hospitals (Jaipur) Pvt. Ltd. • Jaipur (Rajasthan)

Authorized Signatory

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The certificate is awarded to

Name -Dr.Neelam Meena

In recognition of having successfully completed her
Internship in the department of

Name of Department-Operations Department

And has successfully completed her Project on

Efficiency of Central Sterile Supplies Department of a Multi-specialty hospital

Date: 6 FEB 2017- 6 MAY 2017

Organization: Manipal Hospital, Jaipur

She comes across as a committed, sincere & diligent person who has a
strong drive and zeal for learning

We wish her all the best for future endeavors

Manipal Hospitals (Jaipur) Pvt. Ltd. • Jaipur (Raj.) •

Training & Development

for **Head-Human Resources**

THE IIHMR UNIVERSITY, JAIPUR

CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled **Efficiency of Central Sterile Supplies Department of Multi-Specialty Hospital** and submitted by **Dr Neelam Meena** Enrollment No **IIHMR-U/01/2015-17/0308** under the supervision of **Dr Seema Mehta** for award of **MBA in Hospital Management** of the University carried out during the period from **February 06, 2017 to May 06, 2017** embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other institute or other similar institution of higher learning.

Signature

THE IIHMR UNIVERSITY, JAIPUR

CERTIFICATE BY SCHOLAR

This is to certify that all ethical issues have been considered while collecting data for my dissertation titled: **Efficiency of Central Sterile Supplies Department of Multi-Specialty Hospital**

Signature of student

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I would also like to thank all other people of Manipal Hospital who helped me make this report a meaningful one.

Dr.Neelam Meena

IIHMR BATCH -20

MBA Hospital administration

IIHMR,Jaipur

Contents

ABBREVIATIONS:

CSSD	central sterile supplies department
ETO	Ethylene oxide sterilization
MVI	multi viral indicators
NABH	
NABL	

DISSERTATION REPORT

INTRODUCTION

Sterilization as the infection control technique forms the most essential and important practice in the control of disease transmission and propagations. It is not economically feasible to plant sterilization equipments in all the departments of the hospital. So it was thought better to centralize all the activities of the hospital in a single department under the direct supervision of trained personnel. This department is It is the major support area in the hospital. The setting up of this CSSD resulted in saving of nursing time, sterilization **called "central sterile supplies department" or CSSD.**

Work Flow and space planning in CSSD department:-

- Major activities in a CSSD are:
- Receiving the used items from user departments
- Cleaning
- Packing
- Sterilizing
- Storing (temporary)
- Distributing to user departments

These activities are carried out in above sequence and efforts are made to maintain a uni-directional flow of activities so that sterile and unsterile items remain separate. Accordingly the space programming is done. Each area is described below:-

Receiving Area

- Used items from various departments of the hospital are shifted to CSSD for cleaning and sterilization. Ideally the items that get soiled with blood or body fluids should be decontaminated with sodium hypochlorite solution in the user departments itself so that the staffs who handle these items for transportation or cleaning are not exposed to the risk of contacting infections. After decontamination, they are shifted to CSSD. The staff of the user department or through centralized staff can transport these items to cssd either.
- The receiving area of CSSD should have access to outside through a window with a counter. The items (especially for instruments in trays) are counted and received. Thereafter ,the instruments are inspected and blunt/ unsuitable instruments are segregated/ discarded. Necessary entries are made for records. Thereafter the items are shifted to cleaning area.

Cleaning Area

- Here the instruments are washed either manually or in machines. For MANUAL, washing sinks with water supply and working counters are organized. Detergents and brushes of various sizes and shapes are required in this area. Ultrasonic washer is a machine used for cleaning surgical instruments. It converts high frequency sound waves into mechanical vibration that produces small bubbles that burst on the internal surfaces of instruments and dislodge the waste particles.
- Tunnel washer is highly sophisticated and expansive machine that ALLOWS totally hand-off processing. Instruments in perforate or mesh bottom trays coming from operating room or other departments are placed into the tunnel washer without any further handling. The instruments are subjected to cycles washing, rinsing, ultrasonic cleaning and drying. Most of the hospitals cannot afford these washers.

- After the instruments are washed, they are dried in oven dryer and shifted to packing area.

  If used items are not decontaminated in user department than blood/ body fluid soiled should be decontaminated with sodium hypochlorite before handling further.

Packing Area

- Clean and dry instruments are packed before sterilization so that they are not contaminated while handling after they are sterilized. Working counters are required in this area. Most of the instruments are packed in trays (tray assembly) that are wrapped with double layer of cotton cloth. Paper envelopes are also available for packing the instruments. These are equally effective but expansive. Plastic bags (ETO bags) are used for packing the items for ETO sterilization. The packs are labeled indicating date of sterilization and date of expiry (wherever possible).
- Sealing machine is used for the sealing the plastic bags in which instruments are packed. After packing and SEALING, the instruments are shifted for sterilization.
- A large quantity of cotton balls and gauge pieces are used in various patient care areas and are required to be sterilized before using them. Traditionally these are prepared in the CSSD. Cutting the gauge is very arduous job and is done with the help of Gauze cutting machine. During the process of gauge CUTTING, the cotton fibers ARE dispersed in the air and may get settled on the sterilized items spoiling them. Therefore, a separate room is required for cutting the gauge and preparing cotton balls adjacent to the packing area.

Sterilizing Area

- Sterilization is done by either of the two methods in CSSD:
- ❖ Steam sterilization by autoclaves
- ❖ Gas sterilization by ETO (ethylene oxide) machines
- ❑ *Autoclave:* Steam under pressure is the most cost-effective method of sterilization, therefore, most commonly used for sterilization of instruments and linen in hospitals. "Autoclave" is the name of the machine that generates steam at a temperature of 121 degree centigrade under 15 pounds of pressure. An exposure of 20 minutes is required for sterilization. Before feeding the steam, vacuum is generated in the chamber of the autoclave so that no air pocket remains in the folds of linen and the steam IS distributed uniformly in the chamber.

1. Autoclave is available with single door or double doors. Double door autoclaves have two doors on two opposite sides and have the advantage of maintaining uni-directional movement of materials. The unsterile items are fed into the chamber through one door and the sterilized items are taken out from the other door of the autoclave.
2. The autoclaves of different capacities are available- 1/2, 1, 2 ton etc. and can be selected depending on the work load.

- ❑ ***ETO Sterilizer:*** The items like cardiac catheters are thermo sensitive (damaged by heat) and therefore cannot be sterilized by steam. Such items are sterilized by ethylene oxide (ETO) gas sterilization. The ETO is an expansive and toxic gas. The items that are to be sterilized are placed in a chamber that is filled with ETO. As a result of the exposure to the gas all organisms attached to the item get killed but the item gets coated with gas molecules. It is absolutely necessary to ensure that these items are made free of gas molecules before using them on a patient. This is achieved by subjecting the items to forced ventilation. The entire cycle of sterilization and ventilation is long and may take

about 8- 12 hrs. For each cycle of gas sterilization one ETO cartridge is required that is fixed with the machine before starting the cycle.

- ***Flash sterilizer:*** This is a special type of autoclave that has a very short sterilization cycle of about 3 - 5 minutes because of its ability to raise the temperature to 132 degree centigrade. The machine is generally kept in the OT. During the operations if there is urgent a requirement of sterilizing an instrument, it is done on flash sterilizer.

Store

After STERILIZATION, the items are temporarily stored in a clean store (on racks) from where they are distributed to user departments

Support Areas in CSSD

- The following support areas would be required in a CSSD

1. CSSD Managers office
2. Workers rest room with lockers and toilet facility
3. Unsterile Stores for cotton, gauge, linen and instruments

OBJECTIVES OF THE STUDY

- To study existing sterilization techniques of the Central sterile supplies department in a tertiary care hospital.
- To analyse efficiency of sterilization equipments of central sterile supplies department in the hospital.

REVIEW OF LITERATURE

Until the 1940 the medical surgical supplies were processed and maintained in the department and patient care area in which they used. It was difficult to maintain consistently high standard for sterilization technique and product quality. Therefore, centralized processing was needed for efficiency, economy and patient safety.

According to Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008, it reviews sterilization technologies used in healthcare and makes recommendations for their optimum performance in the processing of medical devices. Different types of sterilization techniques:-

1) Steam Sterilization: Of all the methods available for sterilization, moist heat in the form of saturated steam under pressure is the most widely used and the most dependable. Steam sterilization is nontoxic, inexpensive 826, rapidly microbicidal, sporicidal, and rapidly heats and penetrates fabrics.
2)Flash Sterilization:- "Flash" steam sterilization was originally defined by Underwood and Perkins as sterilization of an unwrapped object at 132o C for 3 minutes at 27-28 lbs. of pressure in a gravity displacement sterilizer843.

3) Low-Temperature Sterilization Technologies:- Ethylene oxide (ETO) has been widely used as a low-temperature sterilant since the 1950s. It has been the most commonly used process for sterilizing temperature- and moisture-sensitive medical devices and supplies in healthcare institutions in the United States. Two types of ETO sterilizers are available, mixed gas and 100% ETO.

4) Hydrogen Peroxide Gas Plasma:- New sterilization technology based on plasma was patented in 1987 and marketed in the United States in 1993. Gas plasmas have been referred to as the fourth state of matter (i.e., liquids, solids, gases, and gas plasmas). Gas plasmas are generated in an enclosed chamber under deep vacuum using radio frequency or microwave energy to excite the gas molecules and produce charged particles, many of which are in the form of free radicals

5)Peracetic Acid Sterilization:-Peracetic acid is a highly biocidal oxidizer that maintains its efficacy in the presence of organic soil. Peracetic acid removes surface contaminants (primarily protein) on endoscopic tubing711, 717. An automated machine using peracetic acid to sterilize medical, surgical, and dental instruments chemically (e.g., endoscopes, arthroscopes) was introduced in 1988.

According to study by M. A. R. FREEMAN Clinical Assistant, Surgical Unit AND C. F. BARWELL Professor of Bacteriology, The London Hospital Materials which cannot be sterilized by heat are being used increasingly in medicine, and their sterilization at the present time is not entirely satisfactory. Ethylene oxide is in use in the United States of America and in Sweden to produce sterility at room temperature, but so far it has only been used on a limited scale in hospitals in this country.

The literature on ethylene oxide is extensive and dates back to 1936 when Schrader and Bossert patented the use of alkylene oxides for killing 'pests and germs'. The variables upon which ethylene oxide sterilization depends have been investigated and reported by, among others, Phillips (1949), Kaye & Phillips (1949) and Sykes (1958).

As Infectious Disease Epidemiology Section Office of Public Health Louisiana Dept of Health & Hospitals, 2011:-

1) Chemical indicators are paper strips, tubes containing granules or fluids that change colour at a particular temperature. They are used inside the packs or outside the packs to distinguish sterile from unsterilized items.

2)Biological indicators are standardized preparations of bacterial spores (the most resistant form of microorganisms). They are placed among the equipment. After sterilization, the spores are placed in a suitable growth medium and incubated at the proper temperature. No growth should be observed. Bacillus stearothermophilu are commonly used.

According to I.B Singh and Hem Chandra view of the consumer production act and quality controls procedures in CSSD too should be followed. Inspection, assembling and packing of CSSD items should be carried out so as to help achieve efficiency in sterilization.

According to Malika Rajan, sterilization is an important but often not visible manufacturing function. It is an unrecognized element in a vast number of industries and manufacturing process.

As per the Joint commission on the accreditation of health care organization recommends that each institution have policies and procedures in place to address infection surveillance, prevention and control in the areas where the procedures are performed.

Thomas Ritchie Pontas states that the sterilization ratio higher than 2% error calls for an investigation in each case. It should be individually taken for error in technique and treatment so that preventable cause may be removed preventing infection in subsequent cases.

Kane says, in many developing countries, use of unsterilized or improperly sterilized needles and syringes, is common and cause of millions of cases of viral hepatitis B and D as well as contributing to spread of HIV. To combat this problem, WHO has stimulated the development of 'autodestruct' syringe with all vaccines supplied for emergency purpose.

Diechekass points out that patients' with critical illness requiring aggressive medical intervention are at risk of acquiring serious nosocomial infection. Policies for effective antibiotic utilization, disinfection of medical devices through proper sterilization and patient isolation, may limit nosocomial infection in this population.

Bissette states that human hepatitis B virus is an important cause of nosocomial infection and can be transmitted by contaminated instruments. After the evaluation of sterilization procedures they conclude that, Hydrogen gas plasma sterilization process completely inactivate a DHBU a representative of Hepa DNA group of virus.

According to Sakharkar the main item of equipment in the CSSD is autoclave. Other equipment in the CSSD includes the following: dry oven, gauze cutter, ultrasound washer, needle flushing device, autoclaves, ethylene oxides sterilizer work benches with marble or stainless steel top, storage cupboards and racks, linen folding table, soaking sinks, high pressure water jets.

According to Dr. P.N. Ghei and Dr. Mrs. P. Ghei, the methods of sterilization are, Sterilization by heat, dry heat sterilization, sterilization by chemicals, testing methods for chemicals disinfectants. The newer methods of sterilization are sterilization by ethylene oxide, P-propiolactone radiation of sterilization, gas filtration sterilization system etc.Hot air oven sterilization: The hot air oven uses a dry heat sterilization process is applied for the sterilization of article made of glass or metal .It cannot be used for liquid media. The inner chamber of the oven has adjustable shelves. The thermostat is used for adjusting the required temperature

.

According to Kanai L. Mukherjee[13], Autoclaving is the most effective and most commonly used method of sterilization.

The method of choice for all instruments in autoclave, using one of the following time temperature combinations:-

TABLE 1

Temperature	Minimum hold time minutes
134-138	3
126-129	10
121-124	15
115-118	30

PACKAGING OF STERILIZED DEVICES

After sterilization a barrier is required to protect the packed medical devices and to maintain sterilization up to the point at which they will be used. Therefore every medical device has to be sterilized and packed. The choice of packing material depends on several important criteria, they are as follows:-

- ✓ Material should not release harmful substances and not have considerable change (chemical or physical) during the process of sterilization.
- ✓ The material should be able to packed easily; it should be soft and strong enough for packaging, sterilization, transport and storage.
- ✓ It must show damages and should not create false safety (pinholes).

STERILIZATION INDICATORS

The use of accurate and precise chemical indicators as part of the sterilization monitoring procedure will help to increase significantly the quality assurance level. Indian standard, states about the different types of indicators, which are used for different type of sterilization process. These are as follows:

Indicators for Steam Sterilization:

Chemical Indicator: The chemical indicators, such as tapes, are employed to detect the conditions of sterilization in the chamber.

Biological Indicator: Disk or strip containing about a million spores of Bacillus Stuarothemophilus are used as biological indicators to prove the adequacy of the sterilization process.

Biological Indicators for Dry Heat Sterilizer: Bacillus subtilis Disk or strips are used

Indicators for Ionizing Radiation Sterilizer:

Chemical Indicators: Chemical indicators such as tapes are employed in which change of color indicates the conditions of sterilization.

Biological Indicators: Disks or strips containing about a million spore of suitable strain of Bacillus pumilus are utilized as biological indicators to monitor the sterilization process using gamma or other ionizing radiation

According to Shakti Gupta and Sunil Kant[34] (2000), utilization essentially means the use of the equipment to the full potential. Utilization index or Utilization co-efficient is one of the most important parameters to monitor the functional status of the equipment. It is the parameter to assess the productivity of a service or equipment.

$$\text{Use co-efficient} = N/M \times 100$$

Where, N= Average number of hours the equipment is used per day.

M= Maximum number of hours the equipment can be used per day.

- If the coefffiecient of utilization is less than 50% than it is under utilized

TABLE 2:SHOWING THE NUMBER OF AUTOCLAVING CYCLES DONE PER MONTH IN EACH AUTOCLAVE

MONTHS	AUTOCLAVE A	AUTOCLAVE B	TOTAL
March	90	101	191
April	100	108	208
May	141	134	275

- The average running time of each autoclave was taken to calculate the total volume autoclaving per machine as shown in the table

TABLE 3: SHOWING THE AVERAGE NUMBER OF TRIPS AND THE TOTAL VOLUME OF AUTOCLAVING OF EACH AUTOCLAVE PER DAY

Autoclave	Average trips per day	Capacity per trip Cu.ft.	Total autoclaving per trip cu.ft.
A	3	3.5	10.5
B	3.5	3.5	12.25
			TOTAL=22.75

MATERIALS AND METHODS:

- **STUDY DESIGN**: Observational study.
- **SETTING**: Manipal Hospital,Jaipur
- **DURATION OF STUDY:** Feb 2017 – May 2017.
- **SAMPLING TYPE**: convince sampling
- **DATA COLLECTION METHOD:-** Data was collected from the records and checklists of the department.
- **SAMPLE SELECTION**: All staff working and equipments used in the CSSD during the study period.
- **DATA COLLECTION PROCEDURE:** Primary data will be collected from direct observation, interview and discussions with staff. Secondary data from hospital manuals, policies, records and checklists are used for acquiring information on equipment utilization.
- **DATA ANALYSIS PROCEDURE**: Data collected would be analyzed using MS excel

PROCESS FLOW IN CSSD DEPARTMENT OF MANIPAL HOSPITAL

UNSTERLIZED ITEMS LIKE SURGICAL ITEMS , GOWNS , RUBBER ITEMS , PLASTIC ITEMS CAME AT RECEIVED AREA OF CSSD DEPARTMENT FROM OT , GENERAL WARD, CATH LAB ETC.

⇩

ITEMS RECEIVED BY CSSD STAFF AND COUNT & CHECK THE ITEMS IN QUANTITY AND GIVE RECEIVED SIGN TO GDA

⇩

CSSD STAFF SEPRATE THE RUBBER ITEM , PALSTIC ITEMS FROM METAL ITEMS AND CLOTHES

⇩

STAFF PASTE LABELS ON EACH ITEM WITH DATE AND EXPIRY OF STERLIZATION

⇩

GOWNS AND SURGICAL ITEM READY FOR STERLIZATION IN AUTOCLAVE	RUBBER, PLASTIC ITEMS PACKED IN BAGS FOR STERLIZATION
⇩	⇩
CHECK WATER LEVEL OF MACHINE	MACHINE TEMPRATURE MAINTAIN FROM 39^{O}C TO 50 ^{O}C
⇩	⇩
START HEATING PROCESS OF THE MACHINE	INSTALL GAS AMPULL, ONE PAK UNIT, ONE STRIP IN THE ETO MACHINE
⇩	⇩
DRY PROCESS OF MACHINE	LOAD ITEM WITH BATCH NUMBER ACCORDING TO LOT IN THE ETO
⇩	⇩
STARTING PROCESS OF STERLIZATION	CLOSE THE DOOR OF MACHINE, TURN SWITCH ON OF THE MACHINE
⇩	⇩
INITIATE FAST DRY PROCESS OF MACHINE	CLOSE THE DOOR OF MACHINE, TURN SWITCH ON OF THE MACHINE

There are 2 autoclaves. The specifications are as follows:

- Operating pressure = 1.2 kg/cm^3
- Operating temperature = 121^oC – 124^oC
- Designed working pressure = 1.26 kg/ cm^3
- Space – 3.5cu.ft.
- Diameter- 22inches
- Electrical operation needs =415 volts
- Hydrostatic test pressure: -

  Jacket = 2.6kg/cm^3

  Chamber = 1.9 kg / cm

- Connected - 400/ 440V.

TABLE 4:-

STEAM STERILIZATION	TEMPERATURE	MINIMUM HOLDING TIME	YES	NO	
	115°C to 118°C			no	
	121°C to 124°C	2hrs to 2 1/2hrs	yes		
	126°C to 129°C			no	
	134°C to 138°C			no	

The process of steam sterilization is carried out as follows:-

- ✓ The materials for autoclaving are prepared with indicator paper.

  a. The autoclave is filled with water as follows:

i) Water inlet valves are opened.

ii) Operating valve is put in 'Vaccum dry' position.

iii) Water is filed up to the 3/4th glass level marked

iv) The water valves are closed and operating valve is put in the slow / off position after filling.

- ✓ The autoclave is switched on wait for 45 minutes to 1 hour till the right side pressure gauge indicates 18PSI.

The machine is loaded and then the door is closed tightly the operating valve is put in to the 'ster' position. Both gauges have to read 18 PSI. The bottom temperature will increase to 121^{o}C.

- ✓ After 15 to 20 mins, which is the holding time, put the operating valve in to 'Fast' Exhaust position. The left side pressure gauge and the temperature gauge will come down.
    - When the left side pressure gauge comes to 'Zero' the operating value is put in to off / slow position. Thereafter the door is opened & the load is taken out. The autoclaves are washed thoroughly with water after the removal of every sterilized load glove powder is used for the door gasket.

TABLE 5-

	BIOLOGICAL INDICATORS	YES	NO
a.	Bacillus Stearothermophilus	Yes	
b.	Bacillus pumilis		No
c.	Bacillus subtilis		No

TABLE 6:-

Event	Color Change
Spores survive cycle	Culture Medium orange
Spores Have been killed	Culture medium turns black

TABLE 7:-

	CHEMICAL INDICATORS	YES	NO
a.	Adhesive sterilization tape	yes	
b.	Specially marked sterilization pouches	yes	
c.	Bowie dick test sheet	yes	
d.	TST control TM indicator	Yes	
e.	Multivariable MVI indicator	Yes	
f.	Steam sterilization Integrator	Yes	

TABLE 8:-

	MECHANICAL INDICATOR	YES	NO
a.	TIME CHART	Yes	
b.	PRESSURE CHART	Yes	
c.	TEMPERATURE CHART	Yes	
d.	HUMIDITY CHART	Yes	

TABLE 9:-TOTAL NUMBER OF ITEMS AUTOCLAVED PER DAY IN CSSD DEPARTMENT OF MANIPAL HOSPITAL

SR. NO.	Name of set	ITEMS AUTOCLAVED	quantity
1	General set	Big sheet Small sheet Gown towel	3 6 4 4
2	Ortho gen set	Big sheet Small sheet Gown Towel	5 5 4 4
3	TKR/THR set	Big sheet Medium sheet Gown Towel	10 8 6 6
4	TKR/THR draping set	Big sheet Medium sheet Small sheet Gown Sponge Bowl	2 1 2 1 4 1
5	Epidural set	Sponge holder Bowl Gown Towel G cut sheet	1 1 1 1 2

		Medium sheet	1
6	Spinal set	Sponge holder Bowl Cut sheet Gown with towel	1 1 1 1
7	Neuro set	Big sheet Small sheet Gown Towel	8 8 5 5
8	Neuro cut sheet	Laminectomy sheet Craniotomy sheet Small cut sheet c-arm coller lapcholi bag	4 4 4 2 2
9	Cut sheet set drum	C-arm coller Small cut sheet Lapcholi bag Laggings Gown with towel	2 4 4 4 2
10	LSCS set	Gown towel big sheet small sheet medium sheet	4 2 2 5 2
11	MTP set	cut sheet medium sheet small sheet gown with towel laggings	1 1 1 1 2
12	long line set	gown with towel cut sheet medium sheet	1 3 2
13	suture set	kidney tray small bowl small scissor tooth forceps artery forceps needle holder sponge holder	1 2 1 1 1 1 1
14	long line set	Bowl small scissor artery forceps needle holder tooth forceps	2 1 1 1 1
15	Tracheotomy	kidney tray bowl small tooth foreps allies forceps needle holder	1 1 2 2 1

		right angle retractor towel clips hook retractor sponge holder mayo scissor knife handle trickle hook instrument holder	2 1 1 1 1 1 1 1
16	dressing set	Bowl Artery	10 10
17	reopen set	reopen set	81
18	E.C tray	sponge holder needle guide bowl	2 2 4
19	E.T. tray 1st set	sponge holder bowl cusco's instrument	4 2 2
20	ET tray 2nd set	sponge holder bowl cusco's	6 3 3
21	IUI tray	sponge holder cusco's bowl	2 1 1
22	Delux dressing set	dressing set	5
23	Delux suture set	suture set	1
24	Delux suture cutting set	suture cutting set	2
25	bone marrow set	sternace puncture needle s.s. bowl sponge holder disecting forceps plain disecting forceps toothed kidney tray	4 2 1 1 1 1
26	Gyneic set	Instruments used	23
27	MICU Neuro surgery set	Instruments used	10
28	MICU suture set	Instruments used	9
29	MICU ENT set	Instruments used	9
30	MICU Tracheostomy set	Instruments used	24
31	MICU V.P. shunt tray	Instruments used	10
32	MICU dressing set	Instruments used	2
33	MICU dilator set	Instruments used	12
34	MICU skin traction set	Instruments used	2
35	Labour room delivery set	Instruments used	10
36	L.R. cervical exploration set	Instruments used	9
37	L.R. forcep set	Instruments used	4
38	Cath lab ppi set	Instruments used	41
39	Cath lab CAG+PTCA	Instruments used	14
40	HDU set	Gm roll	1

		Suture set O2 jar Catheter set Suture set Cut sheet Green sheet D/S set	1 2 1 3 4 2 3
41	Emergency	Green sheet D/S set Suturing tray Cut sheet Catheter set Doctor gown Nasal packing tray Tracheotomy tray	6 7 4 3 1 1 1 1
42	NICU	Humidifier Nasal packing	1 1
43	Dialysis set	Instruments used	18
total number of items autoclaved per day =593			

TABLE 10 :- NUMBER OF ITEMS AUTOCLAVED PER DAY OVER A WEEK

Items autoclaved	13/4/2017	14/4/2017	15/4/2017	16//2017	17/4/2017	18//2017	19/4/2017
	406	561	543	574	458	591	588

Maximum time each autoclave can be used is around 10hrs

Therefore, for two autoclaves the combined utilization is,

N = 6, M = 10

Utilization coefficient = 6/10 x 100

= 60%.

- The two autoclaves are being utilized up to 60%.

Weekly workload on the autoclaves