

LINEN FLOW CYCLE IN A LEVEL 1 TRAUMA SET UP: OUR EXPERIENCE AT JPN APEX TRAUMA CENTRE AIIMS, NEW DELHI



Healthcare

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ABSTRACT

Introduction: This study was carried out with the aim to analyze Linen Usage at an acute care center, JPN Apex Trauma Centre and to find out the flow of linen in the hospital and formulate a Linen Utilization Management Plan. We also wanted to quantify the daily load handled by the Laundry and Sterilization unit and how much Linen is effectively in circulation in JPN Apex Trauma Centre.

Methods: This prospective study was carried out at the Jai Prakash Narayan Apex Trauma Centre, All India Institute of Medical Sciences, New Delhi from June, 2014 to November 2015. Data was collected through observation, survey, interviews and through the study of records maintained in various sections of the center by a team of Textile Department, Indian Institute of Technology, New Delhi. Literature survey were taken along with repeated visits to various departments of JPN Apex Trauma Centre. Interviews of department personnel were taken and collaboration from official records was also done. Survey of staff was also conducted.

Results: Linen Store is the place where the freshly procured linen is received and stocked. Central Sterile Supply Department is the backbone unit of the hospital. A committee should be formed which checks that the technical specifications of the linen procured is in line with the sample which is provided before for checking and that quality is not compromised. The current study revealed certain deficiencies in the linen management process, but the linen and laundry service is providing a satisfactory service to its users. However improvement can be made by taking steps to eliminate the present deficiencies.

KEYWORDS

A.s. – Abdominal Sheet, D.s. – Draw Sheet, T.c. – Trolley Cover, B.s. – Bed Sheet, O.t. – Operation Theatre, C.r. – Craniotomy

BACKGROUND:

Hospital management in modern milieu has become patient oriented. [1] Efficiency driven services are of paramount importance to uplift the standards of care for the patients. A large amount of linen is consumed in every hospital. To perform in its true perspective and facilitate the patient care process these support services are indispensable. Linen and laundry is a recognized support service which not only ensures prevention and containment of hospital infection but also contributes to the reputation of a healthcare set up. Linen as per the dictionary refers to a flex or an article of cotton. [2] However, in hospital based set up linen is defined by the clothing material for the patient, medical and Para-medical staff and also the clothing material used for the patients care services in operation theatres, beds trolleys including the mattresses, pillows, blankets, sheets and towels etc. [4, 5] Considering its widespread application, the procurement of linen and its subsequent laundering, sterilization and maintenance can be a huge burden on the hospital. This study was undertaken to collect data about the procurement, use, consumption and maintenance of linen at the Level 1 Trauma Centre at AIIMS, New Delhi. Data was collected through observation, survey, interviews and through the study of records maintained in various sections of the center. [6, 7] In this study, observations and data collection was done in 4 service units in the Trauma Centre (TC) namely the Linen store, Central Linen facility, Laundry and the Central Sterile Supply Department which are involved in the procurement, issue, maintaining and servicing of linen respectively.

Classification of Hospital Linen [3, 11, 12, 13]

Classification of Linen based on application category

a) General Purpose linen: This includes curtains, drapes, table clothes and similar items commonly used in all parts of the hospital. This is the linen which is not used for patient care.

b) Patient linen: This consists of patient clothing such as patient pyjamas, shirts, gown, coats etc. worn by patients.

c) Ward Linen: This consists of patient bed clothing such as bed sheets, pillow covers, blankets used by the patient.

d) OT, Labour room, Procedure room linen: This includes items such as pyjamas, kurtas, gowns, coats, shirts etc. worn by surgeons, anaesthetists, OT personnel's and also surgical gowns, caps, masks, trolley covers, OT towels etc. required in OT, labour room and procedure room.

OBJECTIVES: The objectives of this study were

1. To Document the flow of linen through the Trauma Centre,
2. To Quantify the daily load handled by laundering and sterilization unit and
3. To Identify potential areas for improving the handling and processing of hospital linen.

METHODOLOGY

This study was a prospective observational study carried out at the Jai Prakash Narayan Apex Trauma Centre, All India Institute of Medical Sciences, New Delhi for a total duration of 2 years from June, 2014 to June 2016. Literature review was conducted to see if other hospitals have conducted such surveys and findings. Past conducted studies were used as guidelines for the data collection and analysis for this study.

This study was carried out with observation, interview, and questionnaire. For Observations all sections were visited and the various operations in each section as well as the flow of work was recorded. There was lack of e-procurement system in AIIMS store, purchase and other departments. All records were surveyed manually and compiled from maintained registers. Quantitative data related to incoming linen and outgoing linen in each section was perused from the registers made available to us by the staff in the concerned unit. Interviews were conducted with the staff against the backdrop of checklist which was validated by linen purchase committee. Activities included collection of data from the records in the Linen Store about

the nature, quantity and cost of linen purchased by TC in one year. Data for the last commercial year was collected. The duration varied for different departments. For the Laundry department, data was collected for the month of October 2014 and was extrapolated further as the figures were relatively same for each month. Similarly for Central Linen Facility, the duration was from June 2014 to November 2015. Information about the purchase procedure was also obtained from the Linen Store for the year of 2014-15 and also for the current year. Information was collected from the staff members and data was collected from their records on the requirements of wards as well the quantity of linen condemned per month. Quantity and cost of linen condemned per year was also calculated and compared with the amount of linen procured by the Linen Store to get an idea about the linen incoming and outgoing from the JPNATC, AIIMS, New Delhi. Flow of linen in the hospital was analyzed completely. [Fig 1]

LINENSTORE

Linen Store at the JPN Apex Trauma Centre is responsible for procurement of linen, where linen is received and stocked. The Technical Specification Evaluation Committee (TSEE) of the Centre is responsible for decision of final technical specification of the linen to be procured. Pre-bid meetings are held where Vendors come with their samples. The samples are then tested through Visual Inspection only and no technical examination is conducted to verify the merit of the sample. Their samples are approved according to the specification and after which the lowest bidder gets the tender. Sometimes, the quantity which is received in bulk is not of the same quality as compared to the sample. The complete record of linen items procured by Trauma Centre (TC) is kept in the store in hard copy. [Table 1] Various linen items procured by the Linen Store on behalf of JPNATC, AIIMS are circulated in the various departments of the hospital. As per our conducted study, bed sheet is having the highest cost of procurement along with Draw Sheet, OT Towel and OT gowns while items such as perineal Cut Sheet, Legging Bag, Syringe Wrapper and Frock Tarry Coat have a procurement cost of Rs. 0, as the stock which was procured in 2006 is still being used and thus no new stock was procured (Fig 2, 3). On comparing the "inflow" data from Central Linen Facility with the "outflow" data from Linen Store, we can see that most of the items have a difference greater than zero while items such as Blanket, Draw Sheet, OT Towel and Craniotomy Sheet have a negative difference. The net difference is coming out to be -135415.43 for the hospital as procured items are still in circulation. [Fig 5] While items such as Bed Sheet, Draw Sheet and OT Towel are being used extensively by the hospital and thus they are being condemned at a much faster rate and hence the requirement for them is much higher in the hospital. It has also been observed that patients are taking the linen items with them on being discharged from the hospital which is causing a major discrepancy in the numbers. Condemnation was done by some wards before time which led to a decreased condemnation rate. At times, items are directly being disposed in dustbins by patients or the staff and not condemned which can cause this error. Ideally this difference should come out to be zero but the estimate which the hospital is making in terms of requirement is not accurate and here there can be a scope of cost optimization by carefully analyzing this difference. Procurement by the Linen Store is based on requirements specified by the User Departments such as O.T and C.L.F. The amount is calculated roughly by adding:

1. Patient Inflow
2. Linen Losses
3. Linen Condemnation
4. 15% extra

CENTRAL LINEN FACILITY: This facility was set up on 16 June 2014 to act as a buffer for linen between the store section and the wards. It has the responsibility of ensuring that the linen in wards and OTs is always clean and decent. It employs 2 nursing staff under the guidance of 3-4 supervisors who are responsible for the visual inspection of linen and Linen Condemnation. New linen and bedding are kept here which can be issued by all the departments of the Trauma Centre. A trained staff nurse takes a round of the wards going from bed to bed to inspect the quality of bedding. Anything that is not clean, torn or stained is removed and if necessary replaced. Setting up this unit has helped in providing ready access to the garments as they procure the items for each department beforehand and distribute it to the unit whenever required. Hence, the number of bedding issued has increased by 3 times as the process of issuing has become much faster. Torn and stained bed-sheets are removed from circulation much faster. Figure 4

depicts the quantities of items sent for washing per month as recorded by the Central Linen Facility. The quantities are different for each ward. We can see an increase in the number of items sent for washing as more items were then being issued by C.L.F. and thus more amount was put in circulation. This trend can be seen for all the items without exception. Easy issue of items was made possible after setting up of this department which is an interesting thing to note and possibly for other hospitals in the country to follow.

LAUNDRY

The Laundry section is located in the basement of the Trauma Centre. It is an outsourced facility for which tenders are floated and the lowest bidders get the job. They receive around 2000-2500 clothes per day out of which around 1200 are colored. The facility runs from 9:00 a.m. to 9:00 p.m. The garments which are brought are counted and segregated and segregation is done on the basis of their colors. They are washed separately. Industrial washing and ironing of garments is done. Only the gowns are sterilized and hence are kept separately while the dress is washed separately. They employ a total staff of 15, out of which 13 are workers and 2 act as supervisors. All the staff are trained to work on the machines. All the work of delivering and collecting the clothes is done in between 9:00 a.m. to 11:00 a.m. The clothes are segregated according to their color and are washed separately. The washing temperature is 60°C and the detergents used are Ultra, Soda, hypo (removes blood stains), hydrogen peroxide (removes beta-dine stains) as stated by the washer man present at the time. The clothes are put in hydro extractor machine which removes most of the water, then clothes are put in dryer machine for 45 minutes at 60°C. After that, the clothes are put on calendar steam press machine for bulk ironing. They also have two hand presses (Table3). The clothes become unusable after 30 washes. Only O.T. clothes are sent to CSSD for sterilization. On a rudimentary basis, the flow of linen is From Operation Theatre, where clothes are received in Laundry section washed and then sent to the C.S.S.D for sterilization. After sterilization it is again sent back to O.T for further use. Linen from wards are directly sent back to the wards after washing. Items such as OT Towel, Staff Kurta and Staff Pajama are being washed in large quantities while Items such as Legging, perineal Sheet are being washed very less frequently. OT Towel is being used on a much larger scale per day and hence have to be washed more frequently. In Autoclave, besides packaging of instruments, O.T Towels are also used in every little process during any surgery and hence higher consumption. Some issues which were observed during observation include color shade fading on washing. All the products had a different shade of green and the clothes were prone to pilling also. There is contamination of water due to dye being washed out. There are less trolleys to move the clothes.

CENTRAL STERILE SUPPLY DEPARTMENT (CSSD)

Central Sterile Supply Department is the backbone unit of the hospital. After the laundry, clothes are brought to CSSD for sterilization. Before sterilization, stitching, folding and wrapping of clothes is also done (a tailor is assigned for this job). They use Autoclave for sterilization with 2 running currently and 1 for backup. This is an award winning facility for its impeccable track of records and excellent performance. They also have Plasma sterilizers in case there is a problem with CSSD. It is an outsourced facility managed privately. Items which are sterilized in CSSD are linen, sets, gowns, drums, implants, towels and some other instruments (Table2). For removing the blood stains, ultrasonic cleaners are used in the washing area. According to the operations to be performed, they form packets of the instruments and clothes to be used and put in sterilization chambers. There are two types of sterilizations which can be performed according to the thermal properties of the packets i.e. Ethylene oxide sterilization and Autoclave steam sterilization. The materials which have low melting temperature are sterilized using Ethylene Oxide sterilization like Eye shield glass, plastic materials and tubings. The O.T. is directly connected to the CSSD so that the packet does not get contaminated while carrying the packet to and from CSSD. To ensure the non-contamination, triple layered packing is to be used, but in the hospital they are using only double or single layered packing. The autoclave steam sterilization machines have double doors. One of the door opens in the normal non-sterile room from where we put non-sterile packets into the machine and the other one opens in the high pressure sterile room. From here, the sterile packets are directly transported to the O.T. Approximately 450 packets are sterilized daily out of which 150 packets contain only linen (bedsheet, gowns, etc.). The machines used by them are currently 8 years old. In the hospital, they recycle the instruments, i.e., they pack the used instruments (for example tubes, pipes) again and present it to

the patient as new instruments. It is only through Visual Inspection that they decide when to discard the instruments. As stated by them, it does not have the psychological effect on the patient that they are not using used instruments and also helps the poor as they cannot afford the cost of the new instruments.

LINEN CONDEMNATION: Condemnation refers to the discarding of an item which cannot be used anymore. From the data obtained it can be concluded that the condemnation has increased from October 2014 to April 2015 due to the setup of Central Linen Facility. Earlier the staff was in the habit of using the same items again and again irrespective of their condition and the process of issuing new items was quite a tedious one. Members of Central Linen Facility keep regular check on the condition of the items whether they are usable or not and also maintain a stock of the items three times that is being used currently and after the washing of the items they automatically replace them if they are torn or not usable. This has led to increase in linen condemnation. They now also keep a regular check on the bedside items that need washing, so they don't get spoiled easily and therefore the condemnation rate has decreased from April 2015 to August 2015. Causes for Linen Condemnation Include mass casualty deaths where linen may be used for packing dead bodies and cases of shortage of mortuary sheets, where hospital sheet may be used for packing dead bodies. Also no literature supports discarding of linen unless torn. Staining of item and Strenuous Washing Procedure are other causes for Linen Condemnation. Procurement by the Linen Store is based on requirements specified by the User Departments such as O.T and C.L.F. The amount is calculated roughly by adding Patient Inflow, Linen Losses, Linen Condemnation and 15% extra. Linen will only be discarded after physical verification by the on-duty sister in charge/ANS of the clinical area on the same or the next day through NS office.

CONCLUSIONS AND RECOMMENDATIONS

Risk of cross contamination and improved patient experience can be provided by an efficient and effective Linen and Laundry services. These services should promote the patient care and be appropriate to patient group, gender, clinical status, religion and beliefs. If an e-procurement for the entire flow of linen could be made it would enhance the effectiveness of procurement and condemnation of Linen. Besides this it would also be cost effective for hospital set up and management of Linen would be easier. All these parameters would definitely improve overall patient care in any hospital. Furthermore studies could be done to bring about better ways and lessen burden of Laundry in hospital set up.

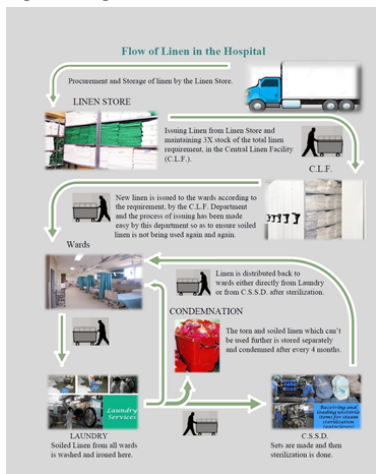


Fig 1: Flow of Linen in the Hospital

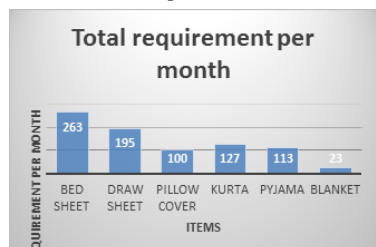
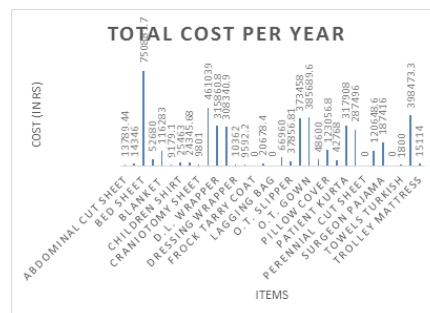


Fig 2: Bar Graph showing Analysis of requirement per item

Table 1: Analysis of requirement per item

Items	Total requirement per month
Bed sheet	263
Draw sheet	195
Pillow cover	100
Kurta	127
Pajama	113
Blanket	23

Fig 3: List of all the linen items procured by the Linen Store, bed sheet is having the highest cost of procurement along with Draw Sheet, OT Towel and OT Towel.



Average number of Sterilized Items from 14/12/15 – 20/12/15

Table 2: Analysis of items per day

ITEM	QUANTITY STERILISED PER DAY
Bed Sheet	192
Draw Sheet	284
D.L.	592
Trolley Cover	510
Gown	497
O.P.T.	1539
Cut Sheet	59
Hand Towel	23

QUANTITY OF ITEMS WASHED

Fig 4: Quantity of items washed per month



Table 3: List of Equipment used in Laundry Section

Equipment	Quantity	In Use/not
Washing Machine – 25 kg	2	Using
Washing Machine – 50 kg	2	Using
Washing Machine – 100 kg	1	Using
Hydro extractor	3	Using
Hand press	2	1 not
Driers	4	Using
Mono Black pump motor	2	Using
Air Compressor	1	Using
Calendar steam press	2	1 not
Flat-bed press	2	Not
Dry Cleaning Machine	1	Not

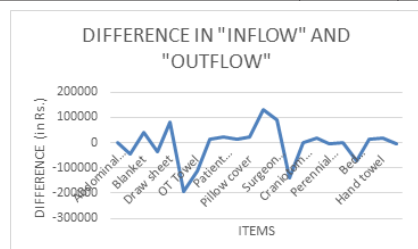


Fig 5: Difference in Inflow and outflow

References

1. Dara Singh, Qadri GJ, *Monica Kotwal, AT Syed, Farooq Jan. Quality Control in Linen and Laundry Service at A Tertiary Care Teaching Hospital in India. *Int J Health Sci (Qassim)*. 2009 Jan; 3(1): 33–44
2. Diploma in Hospital and Health Management Course. Management of Supportive and Utility Service, Ninth Edition. Academy of Hospital Administration, New Delhi, 1998, 109–121.
3. Srikar K, Sharma S, Ghosh SS. Quality Assurance Hospital Linen and Laundry Services. *International Journal of Science and Research (IJSR)* Volume 6 Issue 3, March 2017.
4. Goudar MC, Puranik VC, Kori SA, Quality Management Study of Linen and Laundry Service at a Tertiary Care Hospital. *International Journal Of World Research*, Vol: 1 Issue Xxix, May 2016.
5. Text Book on Hospitals: Facilities Planning and Management by G D Kunders, 2004 Page no 381-388. [2] Hospital Health Building Note 25, Laundry, 1994, amended 2013, NHS Estates, London (available online)
6. Institute of Science and Technology, University of Michigan USA. Hospital Staffing Methodology Manual. MM2 Laundry. 1966
7. American Hospital Association, Chicago, USA. Hospital Laundry Manual of Operation. 1960.
8. Christian RR, Manchester JT, Mellor MT, Bacteriologic quality of fabrics washed at lower than standard temperatures in a Hospital Laundry Facility. *Appl. Environ Microbiol* 1983; 45: 591.
9. Walter WG, Schillinger JE, Bacterial Survival in Laundered Fabrics *Appl. Microbiol* 1975; 29: 368.
10. Russell, Hugo and Ayliffe's. Treatment of Laundry and Clinical Waste in Hospitals. Principles and Practice of Disinfection, Preservation and Sterilization. 4th Edition 2004, 19: 586 - 594.
11. Hospital Tool: Laundry Module: U. S. Department of Labour Occupational Safety and Health Administration. 1966
12. Schwabacher H, Salsbury AJ, Fincham WJ. Blankets and infection: wool, terylene, or cotton? *Lancet*. 1958 Oct 4; 2(7049):709–712. [PubMed]
13. Sakharkar BM. Role of Hospital in Health Care, Principles of Hospital Administration and Planning, 1st Edition, Jaypee Brother. New Delhi 1998; 1; 1-19.