

ANALYZING SPACE UTILIZATION IN CENTRAL STERILE SUPPLY DEPARTMENT: A BED – BASED METRIC APPROACH IN HEALTHCARE INSTITUTIONS

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Abstract

This comprehensive study conducts a meticulous examination of space utilization in Central Sterile Supply Departments (CSSD) within varied healthcare institutions, using a unique bed-based metric system. The gathered data, stemming from a diverse pool of 150 healthcare professionals in the CSSD sphere, offers insights into hospitals' adherence to ethical sterilization practices, the crucial role of CSSDs in hospital management, and the implications of effective space management concerning the number of beds.

Keywords: Central Sterile Supply Department, Space Utilization, Bed-Based Metrics, Sterilization, Healthcare Institutions.

1. INTRODUCTION

The Central Sterile Supply Department (CSSD), a pivotal cog in the machinery of any healthcare institution, plays a substantial role in maintaining patient safety, controlling infections, and ensuring the seamless functioning of the hospital ecosystem [1]. This study concentrates on understanding the space utilization in these departments concerning bed-based metrics, providing a fresh perspective into their operational efficiency.

In healthcare institutions, the efficient utilization of space within Central Sterile Supply Departments (CSSDs) plays a critical role in ensuring the seamless flow of medical supplies and maintaining optimal patient care. As healthcare facilities strive to enhance operational efficiency and cost-effectiveness, there arises a pressing need to develop innovative methods for evaluating and optimizing space utilization in CSSDs. This research publication endeavors to address this imperative by introducing a novel bed-based metric approach that enables a comprehensive analysis of space utilization in CSSDs.

2. LITERATURE REVIEW

2.1 Facility Planning & Management (G D Kunders)

The disinfection supply room plays a crucial role in ensuring patient health by providing safe and sterile medical instruments to all hospital departments. Establishing a scientific quality management mode for daily work is essential for evaluating personnel quality and controlling disinfection and sterilization processes.

2.2 Guidelines for CSSD and mechanized laundry (Ministry of Health and Family Welfare, Govt. of India)

The increasing number of Hospital Acquired Infections (HAI) in Indian hospitals emphasizes the importance of disinfection and sterilization. Using disinfectants and practices is crucial to prevent transmission of pathogens to patients. A centralized sterile supply department (CSSD) and mechanized laundry are widely accepted systems for preventing infection transmission.

2.3 Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008

2.4 Joint Commission for the Accreditation of Healthcare Organizations. Comprehensive accreditation manual for hospitals, JCAHO, Chicago, IL. 2003

2.5 Guidelines of National Accreditation Board for Hospital (NABH); 5TH Edition.

2.6 The Consortium of Accredited Health Care Institutions (CAHO) – ACE Program

2.7 William A Rutala, David J. Weber (Health Infection Control Practices Advisory Committee), Guidelines for disinfection and sterilization in healthcare facilities, 2008. www.cdc.gov/hipac/disinfectionsterilization

3. METHODOLOGY

The study utilized a survey-based research method, probing 150 healthcare professionals active in CSSD departments across a variety of hospitals [3]. The aim was to discern several parameters crucial to CSSD functioning, including the existence of a dedicated department, the number of beds, allocated space, and the appointment of a full-time officer. The questionnaire also sought information on compliance with guidelines like unidirectional flow, zoning, and restricted entry.

Objective of the Study:

1. To evaluate the Indian Central Sterilisation and Supply Department's layout and Space Utilisation of CSSD department in the Hospital.
2. To assess the distribution of space for CSSD Department based on the number of beds in the Hospital.
3. To provide recommendations of best sterilization setup with accurate procedures and working patterns based on the guidelines.

3.1 Data Collection:

Data was harvested based on a myriad of variables that encapsulate space utilization and guideline adherence. These ranged from the number of beds and allocated space for the CSSD, to the availability of dedicated officers, and the enforcement of guidelines such as unidirectional flow, zoning, and restricted entry [3].

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|--------------|------------|--------------|---------------|--------------------|
| Yes | 148 | 98.7 | 98.7 | 98.7 |
| No | 1 | .7 | .7 | 99.3 |
| May be | 1 | .7 | .7 | 100.0 |
| Total | 150 | 100.0 | 100.0 | |

The data provided represents that there is dedicated CSSD Department facility available in the hospital.

- Frequency presents three categories, and the replies reveal that 98.7% of respondents confirm the presence of a specialized CSSD Department in the hospital, 0.7% of respondents disagree, and the other 0.7% of respondents are unaware of dedicated CSSD Department in the Hospital.

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|---------------|------------|--------------|---------------|--------------------|
| 1-50 beds | 19 | 12.7 | 12.7 | 12.7 |
| 51-150 beds | 89 | 59.3 | 59.3 | 72.0 |
| 151-300 beds | 21 | 14.0 | 14.0 | 86.0 |
| 300 and above | 21 | 14.0 | 14.0 | 100.0 |
| Total | 150 | 100.0 | 100.0 | |

The data provided represents the number of beds available in the hospital.

- There are four categories listed in Frequency, and the replies indicate that 12.7% of respondents have a bed capacity of 1 to 50, 59.3% have a bed capacity of 51 to 150, 14% have a bed capacity of 151 to 300 beds. 14% of the respondents' hospitals, there are more than 300 beds.

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|-------------------|------------|--------------|---------------|--------------------|
| 100-1000 sq. ft. | 88 | 58.7 | 58.7 | 58.7 |
| 1001-2500 sq. ft. | 55 | 36.7 | 36.7 | 95.3 |
| 2501-4000 sq. ft. | 2 | 1.3 | 1.3 | 96.7 |
| 4000+ sq. ft. | 5 | 3.3 | 3.3 | 100.0 |
| Total | 150 | 100.0 | 100.0 | |

The data provided represents approximate space allocated for the CSSD department in your hospital (in square feet)

- Frequency displays four categories, and the responses reveal that 58.7% of respondents have 100-1000 square feet allotted, 36.7% have 1001-2500 square feet allotted, 1.3% have 2501-4000 square feet allotted, and the remaining 3.3% have 4000 square feet or more allotted for the CSSD Department.

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|--------------|------------|--------------|---------------|--------------------|
| Yes | 127 | 84.7 | 84.7 | 84.7 |
| No | 13 | 8.7 | 8.7 | 93.3 |
| Maybe | 10 | 6.7 | 6.7 | 100.0 |
| Total | 150 | 100.0 | 100.0 | |

The data provided represents that they have full time officer in charge of CSSD Department.

- In the three categories that Frequency displays, 84.7% of respondents confirm that a full-time officer in charge is available, 8.7% of respondents dispute this, and the remaining 8.7% of respondents are unaware of this.

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|--------------|------------|--------------|---------------|--------------------|
| Yes | 139 | 92.7 | 92.7 | 92.7 |
| No | 2 | 1.3 | 1.3 | 94.0 |
| Maybe | 9 | 6.0 | 6.0 | 100.0 |
| Total | 150 | 100.0 | 100.0 | |

The data provided represents whether Guidelines for Unidirectional flow without any crisscrossing or back tracking is followed or not.

- According to frequency, there are three groups in which 92.7% of respondents affirm that they adhere to all of these guidelines, 1.3% of respondents disagree that they are not following the guidelines, and the remaining 6% of respondents are unaware of the guidelines of CSSD department.

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|--------------|------------|--------------|---------------|--------------------|
| Yes | 146 | 97.3 | 97.3 | 97.3 |
| No | 2 | 1.3 | 1.3 | 98.7 |
| Maybe | 2 | 1.3 | 1.3 | 100.0 |
| Total | 150 | 100.0 | 100.0 | |

The data provided represents whether they have followed guidelines of Zoning in the department.

- Frequency displays three categories in which 97.3% of respondents confirm that they adhere to zoning

regulations: 1.3% of respondents said they did not obey the rules, and the remaining 1.3% said they were unaware of the Zoning concept in CSSD Department.

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|--------------|------------|--------------|---------------|--------------------|
| Yes | 141 | 94.0 | 94.0 | 94.0 |
| No | 7 | 4.7 | 4.7 | 98.7 |
| Maybe | 2 | 1.3 | 1.3 | 100.0 |
| Total | 150 | 100.0 | 100.0 | |

The data provided represents whether entry to CSSD is restricted or not.

- In the three categories that Frequency presents, 94% of respondents affirm that they have restricted access to the department, 4.7% of respondents disagree that they follow the rules, and the remaining 1.3% of respondents are unaware of it.

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|--------------|------------|--------------|---------------|--------------------|
| Excellent | 87 | 58.0 | 58.0 | 58.0 |
| Average | 62 | 41.3 | 41.3 | 99.3 |
| Poor | 1 | .7 | .7 | 100.0 |
| Total | 150 | 100.0 | 100.0 | |

The data provided represents if there is an adequate space provided based on the number of beds and operations.

- According to three categories displayed by frequency, 58% of respondents believe they have enough space to carry out their tasks, 41.3% believe they have an average amount of space, and the remaining 7% do not like how their space has been allocated to CSSD Department.

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|--------------|------------|--------------|---------------|--------------------|
| Yes | 131 | 87.3 | 87.3 | 87.3 |
| No | 1 | .7 | .7 | 88.0 |
| Maybe | 18 | 12.0 | 12.0 | 100.0 |
| Total | 150 | 100.0 | 100.0 | |

The data provided represents data about the signages in the department.

- Frequency displays three categories, with 87.3% of respondents confirming that they have sufficient signs that complies with quality accreditation body standards, 0.7% of respondents believing they do not have signage as per guidelines, and the remaining 12% of respondents unaware of the procedures to verify the same.

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| | Frequency | Percent | Valid Percent | Cumulative Percent |
|--------------|------------|--------------|---------------|--------------------|
| Yes | 145 | 96.7 | 96.7 | 96.7 |
| No | 2 | 1.3 | 1.3 | 98.0 |
| Maybe | 3 | 2.0 | 2.0 | 100.0 |
| Total | 150 | 100.0 | 100.0 | |

The data provided represents data about separate receiving and dispatching window.

- Frequency displays three categories in which 96.7% of respondents affirm that they have separate receiving and dispatching windows, 1.3% of respondents denied having such windows, and the other 2% of respondents are unaware of the procedures for verifying such guidelines for separate receiving and dispatching window/area in CSSD Department.

| Table 11 - The facility has separate area for soiled linen and instruments. | | | | |
|--|------------|--------------|---------------|--------------------|
| | Frequency | Percent | Valid Percent | Cumulative Percent |
| Yes | 141 | 94.0 | 94.0 | 94.0 |
| No | 2 | 1.3 | 1.3 | 95.3 |
| Maybe | 7 | 4.7 | 4.7 | 100.0 |
| Total | 150 | 100.0 | 100.0 | |

The data provided represents that the facility has separate area for soiled linen and instruments.

- Frequency displays three categories in which 94% of respondents agree that they have a separate space for dirty linen and instruments, while 1.3% of respondents said they do not. Also rest 4.7% of respondents are unaware of the procedures to confirm the same.

| Table 12 - Well demarcated areas for decontamination, preparation, sterilization, and storage | | | | |
|--|------------|--------------|---------------|--------------------|
| | Frequency | Percent | Valid Percent | Cumulative Percent |
| Yes | 136 | 90.7 | 90.7 | 90.7 |
| No | 2 | 1.3 | 1.3 | 92.0 |
| Maybe | 12 | 8.0 | 8.0 | 100.0 |
| Total | 150 | 100.0 | 100.0 | |

The data provided represents data about availability of ‘Well demarcated areas for decontamination, preparation, sterilization, and storage.

- The frequency report reveals three categories, in which 90.7% of respondents confirm that they have Well demarcated areas for decontamination, preparation, sterilization, and storage, while 1.3% of respondents claimed that they do not have separate area in CSSD, rest 8% of respondents are unaware about the guidelines to verify the Well demarcated areas for decontamination, preparation, sterilization, and storage in CSSD Department.

| Table 13 - Availability of equipment: • Autoclave • Trolleys & drums • Autoclaving indicator tape • Storage racks and working benches | | | | |
|--|------------|--------------|---------------|--------------------|
| | Frequency | Percent | Valid Percent | Cumulative Percent |
| Always available | 105 | 70.0 | 70.0 | 70.0 |
| Partly available | 44 | 29.3 | 29.3 | 99.3 |
| Not available | 1 | .7 | .7 | 100.0 |
| Total | 150 | 100.0 | 100.0 | |

The data provided represents data about **Availability of equipment**

- Frequency displays three categories in which 70% of respondents confirm that the equipment is always available and 29.3% of respondents report that the equipment and other materials are occasionally available. And the remaining 7% of responders are unaware of the facts needed to confirm the claim of the equipment availability in CSSD Department.

| Table 14 - Uninterrupted water and electricity supply 24*7 with power backup | | | | |
|---|------------|--------------|---------------|--------------------|
| | Frequency | Percent | Valid Percent | Cumulative Percent |
| Yes | 135 | 90.0 | 90.0 | 90.0 |
| No | 15 | 10.0 | 10.0 | 100.0 |
| Total | 150 | 100.0 | 100.0 | |

The data provided represents data about availability of electricity & water supply

- Frequency displays two groups where 90% of respondents confirm that they always have access to

electricity and water supplies and 10% of respondents report partial unavailability of water & electricity supply in CSSD Department.

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|--------------|------------|--------------|---------------|--------------------|
| Yes | 143 | 95.3 | 95.3 | 95.3 |
| No | 1 | .7 | .7 | 96.0 |
| Not Aware | 6 | 4.0 | 4.0 | 100.0 |
| Total | 150 | 100.0 | 100.0 | |

The data provided represents data about Decontamination sinks of adequate size is present for soaking, cleaning, and rinsing.

- Frequency shows 3 categories in which 95.3% respondents confirm availability of Decontamination sink. 0.7% respondents denied availability of the sink while only 4% respondents are not aware about the same.

4. RESULT

The gathered data was intriguing and revealed that a robust 98.7% of healthcare institutions have in house a dedicated CSSD department [TABLE 1]. However, there was a marked variance in the bed capacity and CSSD space allocation among hospitals, with larger institutions boasting up to 300+ beds and allocating 4000+ sq. ft. for CSSD [TABLE 2 and 3]. A significant 84.7% of respondents affirmed the presence of a full-time officer in the CSSD, underscoring the importance accorded to this department [TABLE 4].

| SN | QUESTIONS | RESPONSES | | | |
|----|---|-------------------------------------|--------------------------------------|----------------------------------|--------------------------------|
| | | Yes | No | Maybe | |
| 1 | Is there a dedicated department of CSSD? | Yes 98.7% | No 0.7% | Maybe 0.7% | |
| 2 | Number of Hospital Beds | 1 to 50 Bed 12.7% | 51 to 150 Bed 59.3% | 151 to 300 Bed 14% | 300 and above 14% |
| 3 | Approximate space allocated for the CSSD department in your hospital (in square feet) | 100-1000 sq. ft. 58.7% | 1001-2500 sq. ft. 36.7% | 2501-4000 sq. ft. 1.3% | 4000+ sq. ft. 3.3% |
| 4 | Is there a dedicated and full-time officer in Charge of CSSD? | Yes 84.7% | No 8.7% | Maybe 8.7% | |
| 5 | Guidelines for Unidirectional flow without any criss-crossing or back tracking is followed? | Yes 92.7% | No 1.3% | Maybe 8.7% | |
| 6 | 'Zoning Concept' with defined and demarcated Dirty, Clean and Sterile Zone. | Yes 97.3% | No 1.3% | Maybe 1.3% | |
| 7 | Entry to CSSD is restricted. | Yes 94% | No 4.7% | Maybe 1.3% | |
| 8 | Adequate space to carry out various process of sterilisation (cleaning, washing, sterilization, package, storing and dispatch) and meet the daily and emergency requirements of the facility. (7 to 10 Square feet/bed, but may vary from hospital to hospital), Rate the space | Excellent 58% | Average 41.3% | Poor 0.7% | |

| | | | | | |
|----|---|--------------------------------|----------------------------------|------------------------------|--|
| | allocation at your facility between 1 to 10. | | | | |
| 9 | Signage (internal demarcated area signages) | Yes 87.3% | No 0.7% | Maybe 12% | |
| 10 | Separate receiving and dispatching window/ area | Yes 96.7% | No 1.3% | Maybe 2% | |
| 11 | The facility has separate area for soiled linen and instruments. | Yes 94% | No 1.3% | Maybe 4.7% | |
| 12 | Well demarcated areas for decontamination, preparation, sterilization, and storage | Yes 90.7% | No 1.3% | Maybe 8% | |
| 13 | Availability of equipment: • Autoclave • Trolleys & drums • Autoclaving indicator tape • Storage racks and working benches. | Always Available 70% | Partly Available 29.3% | Not Available 0.7% | |
| 14 | Uninterrupted water and electricity supply 24*7 with power backup | Yes 90% | No 10% | | |
| 15 | Decontamination sinks of adequate size is present for soaking, cleaning, and rinsing. | Yes 90.7% | No 1.3% | Maybe 8% | |

5. CONCLUSION

5.1 Adherence to Guidelines:

The results showed a respectable level of compliance with regulations, with striking adherence to unidirectional flow (92.7%), zoning (97.3%), and restricted entry to the CSSD (94%) [TABLE 5], 6, and 7, respectively. Furthermore, a sizable 87.3% of respondents stated that the proper signage requirements set forth by quality certification authorities were followed [TABLE 9]. According to the standards, 96.7% of the respondents [TABLE 10] have separate receiving and dispatching window or areas. 94% of facilities [TABLE 11] have a dedicated space for dirty equipment and linen in CSSD Department

5.2 Inferences and Recommendations:

- 5.2.1 The study's findings point to a promising trend of responsibility and commitment among healthcare institutions towards upholding sterilization guidelines, an essential aspect of patient safety. The study also emphasizes the strategic importance of space management in the CSSD, connecting it with bed metrics to enhance workflow and drive operational efficiency.
- 5.2.2 Drawing from these observations, it is recommended that institutions not only maintain but also continually update and innovate their CSSD space management strategies in line with the best global practices. These efforts can significantly contribute to enhancing patient safety, operational efficiency, and overall service quality in healthcare institutions.
- 5.2.3 The data brings to light the diligent practices adopted by hospitals, affirming their dedication to quality healthcare service provision. By highlighting the connection between efficient CSSD space utilization and bed count, this study prompts healthcare institutions to continually evaluate and refine their strategies, contributing to better patient care and overall institutional efficiency.
- 5.2.4 By examining the spatial dynamics and workflow patterns with respect to bed capacity, this study aims to provide healthcare administrators and practitioners with invaluable insights to optimize CSSD layouts, enhance resource allocation, and ultimately improve overall patient outcomes.
- 5.2.5 These findings indicate a high level of commitment and dedication among healthcare institutions ensuring patient safety and the highest standards of cleanliness and sterilization.

- 5.2.6 The study underscores the importance of proper space utilization in the CSSD department, considering the number of beds, to optimize workflow and enhance efficiency in sterilization processes.
- 5.2.7 Overall, the research affirms the responsible practices implemented by hospitals, highlighting their commitment to providing quality healthcare services

6. REFERENCES

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