



Original Article: **Enhancing Resurrection Practices for Unusable General Inventory Items in Hospital Settings**

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Keywords: General inventory items, resurrection practices, hospital maintenance, D.G.H. Negombo

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Abstract

Background: Effective patient care in hospitals relies on the proper functioning of medical equipment. Malfunctioning general inventory items, such as patient beds, wheelchairs, and saline stands, pose significant challenges to hospital operations and patient care. D.G.H. Negombo needs help maintaining these items due to limited financial resources and inadequate technical expertise.

Objective: To improve the resurrection practices of selected unusable general inventory items at D.G.H. Negombo.

Methodology: This cross-sectional descriptive study was conducted from August 1, 2022, to November 15, 2023, and involved three phases: pre-intervention (assessment), intervention (implementation), and post-intervention (evaluation). Data collection methods included key informant interviews (K.I.I.), self-administered questionnaires (S.A.Q.), and desk reviews.

The study targeted general inventory items marked for condemnation and included unit heads and maintenance technicians in its scope.

Results: Pre-intervention assessments identified key issues such as inadequate technical skills, poor coordination, and insufficient infrastructure. Interventions implemented included skill development workshops, improved documentation practices, and enhanced communication strategies. Post-intervention evaluations demonstrated significant improvements in repair times, resource availability, and satisfaction among unit heads. Notably, 78% of wheelchairs, 79% of patient trolleys, and 76% of patient beds were successfully resurrected.

Conclusions: The interventions enhanced the resurrection of unusable general inventory items, extended equipment lifespans, and achieved substantial cost savings.

Recommendations: To sustain the progress achieved, it is recommended that D.G.H. Negombo continue focusing on the resurrection of general inventory items, engage skilled volunteers, and implement effective monitoring mechanisms by establishing a focal point.

Keywords: General inventory items, resurrection practices, hospital maintenance, D.G.H. Negombo

Introduction

Effective patient care in hospitals depends on properly functioning medical equipment. Malfunctions can disrupt services, underscoring the importance of maintaining inventory items in good working order.¹ Essential inventory items like patient beds, wheelchairs, and saline stands are essential for hospital operations. When these items malfunction and are not promptly repaired or replaced, it can lead to inefficiencies and affect healthcare quality.²

Background

This research addresses the challenges of repairing and restoring general hospital inventory items. When an item malfunctions, it is reported to hospital administration, which coordinates repairs through the maintenance unit or external agents. Irreparable items are marked for condemnation³.

Justification

This research is justified by the economic challenges at D.G.H. Negombo, where limited funds hinder replacing and repairing malfunctioning inventory items. The lack of skilled maintenance personnel exacerbates the issue, and unusable items accumulate, occupying space and impeding patient care.⁴ Cost-effective interventions

to resurrect these items are crucial for operational efficiency.

Problem Statement

D.G.H. Negombo faces challenges in maintaining inventory items, affecting healthcare quality. The accumulation of unusable items due to limited space, inadequacy of technical expertise, and resources in the maintenance unit necessitates improved resurrection practices.⁵

Project Questions

Does D.G.H. Negombo experience challenges due to inadequate functioning of inventory items, affecting patient care quality?

Are there facilities and resources shortages hindering the resurrection of unusable inventory items at D.G.H. Negombo?

General Objective

To improve the resurrection practices of selected unusable general inventory items in D.G.H. Negombo.

Specific Objectives

To assess the current process and practices of resurrection of unusable general inventory items in D.G.H. Negombo.

To identify the gaps and deficiencies in the current process and practices of resurrection of unusable general inventory items in D.G.H. Negombo.

To develop and implement suitable interventions to overcome the identified gaps in the current process and practices of resurrection of unusable general inventory items in D.G.H. Negombo.

To evaluate the effectiveness of the interventions in the resurrection of

unusable general inventory items in D.G.H. Negombo.

Methodology

The study at D.G.H. Negombo aimed to review and restore selected unusable general inventory items through interventions designed to improve resurrection practices.

The project "Enhancing Resurrection Practices for general Inventory Items at D.G.H. Negombo" was conducted from August 1, 2022, to November 15, 2023. It focused specifically on engaging with all unit heads responsible for general inventory items and technicians of the maintenance unit within D.G.H. Negombo. The project targeted all unusable general inventory items marked for condemnation by the maintenance unit and items not used at present due to malfunctioning.

The project's inclusion criteria encompassed unit heads, maintaining inventories of general inventory items at D.G.H. Negombo, all general unusable inventory items marked for condemning by the maintenance unit, and items that are not in use at present due to malfunctioning. Exclusion criteria applied to general inventory items that were already condemned, as they were not within the scope of this project.

The methodology comprised a cross-sectional interventional study with pre- and post-assessments conducted in three phases: pre-intervention (Phase I—Planning), intervention (Phase II—Execution), and post-intervention (Phase III—Evaluation).

Pre-intervention (Phase I: Planning)

During Phase I, existing processes for unusable inventory item repair were assessed using key informant interviews (K.I.I.), self-administered questionnaire (S.A.Q.), and desk reviews. K.I.I. gathered qualitative data from stakeholders, including the director, medical officers, unit heads, and others involved in inventory management. S.A.Q. assessed unit heads' experiences, difficulties faced and requirements for resurrection. A desk review was used to examine technical issues and storage practices for unusable items. The phase also involved categorizing unusable items based on urgency, breakdown frequency, and resurrection possibility.

Intervention (Phase II: Execution)

Phase II involved executing interventions to enhance resurrection practices of obsolete general inventory items marked for condemnation. This included developing guidance for technicians, improving documentation processes, providing infrastructure support, involving voluntary professionals, implementing a color-coding system, and establishing a focal point for coordination.

Post intervention (Phase III: Evaluation)

Phase III evaluated intervention effectiveness through various metrics including inspecting resurrected items, assessing benefits, and evaluating unit heads' experiences using key informant interviews and S.A.Q.

The project plan was systematically implemented following an organized manner. Initial steps involved are conducting a SWOT analysis to identify internal strengths and weaknesses, as well

as external opportunities and threats affecting maintenance, repair, and resurrection activities. This analysis informed the development of strategies using a TWOS matrix to address identified issues and leverage opportunities. The execution plan was developed collaboratively with stakeholders and formally accepted during unit heads' meetings. A detailed project activity plan and work breakdown structure were established to visualize tasks and ensure effective project management.

Data analysis was integral to understanding the need for resurrection activities of unusable inventory items. Both qualitative and quantitative approaches were utilized. Qualitative data were collected through K.I.I. with officers handling unusable general inventory items and analyzed using NVivo content analysis software. Quantitative analysis involved sample descriptions, data related to inventory handling, desk review and S.A.Q. Pre-interventional analysis provided descriptive insights crucial for designing effective interventions aimed at improving inventory management and repair processes within the hospital setting.

Results

a) Pre-Intervention Results:

Before the intervention, the evaluation of general inventory items indicated several areas requiring improvement. Notably, the pre-intervention qualitative assessment highlighted issues such as repair time, coordination with the maintenance unit, lack of supervision and communication. These aspects were identified as key concerns affecting the efficiency and effectiveness of the maintenance processes for general inventory items.

i. Results of Pre-intervention Qualitative Assessment

Based on the results of qualitative data, current processes and practices for maintaining and repairing general inventory items were identified.

• KII

A table of coding summary were developed after interviewing the fifteen members selected for the K.I.I. of the general inventory items.

The table 1 illustrates the following codes such as insufficient space in wards and maintenance unit, lack of technical knowledge, poor attitude and practices of the maintenance unit personnel

The maintenance unit personnel's lack of technical knowledge and poor attitude and practices achieved the highest percentage (39.9%) of references. Reasons mentioned in the 1st, 2nd, 3rd, and 4th ranks were used to develop interventions.

ii. Results of pre-intervention quantitative assessment

Pre-intervention quantitative assessment was done using, desk review and S.A.Q.

• Desk Review

Selection of unusable general inventory items for the research project

Unusable general inventory items which were identified through a desk review were listed in descending order of unusable items to identify the most affected categories by an expert panel. The first five categories were selected for the application of specially designed criteria to prioritize the three most important categories.

Table 1: Coding summary of pre-intervention K.I.I. for General Inventory Items

Names of the codes and sub-codes	References	Percentage %
Insufficient Space	34	23.7
Maintenance unit space not sufficient	16	11.2
Ward space occupied by malfunctioning items	10	7.0
Difficult traceability	8	5.6
Lack of knowledge, attitude and practice	57	39.9
Technical skills and training not adequate	24	12.8
Poor communication & PR skills	25	17.5
Insufficient Recognition	8	5.6
Lack of Supervision	13	9.0
No technical or supervising officer	8	5.6
Less Documentation	5	3.5
Poor Organizing	18	10.6
The maintenance unit is not organized	8	5.6
Difficulty in finding spares and tools	10	7.0
Time Requirement	21	14.7
Delay in repairs	12	8.4
No fixed date & time for repairs	6	4.2
No mobile repair activity	3	2.1
Total	143	100

The criteria developed included following areas

1. Urgent requirement of the hospital
2. Frequency of breakdown
3. Possibility of resurrection

Based on the above criteria, marks given to the item categories were considered and

wheelchairs, patient trollies and patient beds were identified as prioritized groups.

Table 2 illustrates the gravity of the situation regarding unusable inventory items and it highlights the urgency of resurrection.

Table 2: Number of unusable inventory items selected for resurrection

Name of the Inventory Item	Number of items marked for resurrection (Selected Groups)	Total number in the hospital	Percentage
Selected General Inventory Items			
Wheelchairs	64	80	80%
Patient trollies	38	89	42%
Patient beds	37	610	6%

• S.A.Q.

There were 45 participants who were unit heads of D.G.H. Negombo. They were asked regarding their opinions on the processes established for the resurrection of unusable inventory items. The areas of inquiry were satisfaction with repairs of general inventory items, space occupied by unusable general inventory items, and traceability of such items. The study instrument used for this purpose was the S.A.Q., which was applied before the interventions. Answered S.A.Q.s were analyzed to get inputs to design interventions.

The same S.A.Q. was used to assess the situation six months after the interventions are conducted.

The S.A.Q. was designed to obtain responses using a Likert scale, so the results were obtained in quantitative data format. In analysis, the responses recorded in the Likert scale were grouped and analyzed as a binary variable.

b) Interventions for resurrection of unusable General Inventory Items:

Following the pre-intervention assessment, targeted interventions were implemented to address the identified issues. The interventions aimed to improve repair time, enhance coordination with relevant units,

optimize workspace allocation, and streamline communication processes. By focusing on these areas, the project sought to enhance the overall maintenance and repair procedures specifically for general inventory items within the hospital.

Project implementation mainly consisted of launching thirteen interventions identified based on the results of the pre-intervention. They are:

- Public relations and communication workshop
- Identification of well wishes to assist the project
- Workshop conducted on white steel welding
- Establishment of a precondemning store
- Facilities improved for both in-house workers and other technicians who visit the hospital
- Introduction of guidelines for the maintenance unit personnel
- Issue of an information sheet to unit heads
- Development of a job card
- Form to hand over and take over of unusable general inventory items to outside volunteer technicians
- Setting up of focal point with a dedicated staff
- Assurance of uninterrupted supply of spare parts.

- l) Development of Web-based platform
- m) Formation of WhatsApp group

c) *Post-Intervention Results:*

The post-intervention evaluation demonstrated significant improvements across various parameters related to resurrection of unusable general inventory items. Notably, there was a considerable increase in satisfaction levels regarding repair times, coordination, workspace allocation, and communication. This improvement was evident by quantitative data showing higher satisfaction scores and percentages of positive responses post-intervention compared to pre-intervention. Overall, the interventions led to enhanced efficiency and effectiveness in managing the maintenance and repair processes for general inventory items at D.G.H. Negombo.

Phase III post-intervention results were obtained using two techniques: qualitative assessment through K.I.I. and quantitative assessment through S.A.Q.

i. Results of the post-intervention qualitative assessment

Based on the K.I.I. conducted after implementing interventions following results were derived.

• KII

A table of coding summary were developed after interviewing the same fifteen members who were interviewed for the pre-intervention K.I.I.

The table 3 indicates organization restructuring, resource availability, enhancement of repair speed, improvement to the documentation process and communication improvement as five main codes. Accordingly, the highest number of references (26 %) were received for code on organization restructuring. The codes representing resource availability and communication improvement indicates importance as both obtained an equal number of references giving a percentage of 20%. The two codes on improvement to the documentation process and the enhancement of repair speed received percentages of 13% and 9% respectively.

ii. Results of post-intervention quantitative assessment

Post-intervention quantitative assessment was conducted among unit heads using S.A.Q. The questionnaire used was the same as the one used for pre-intervention assessment.

Table 3: Coding summary of post-intervention K.I.I. for General Inventory Items

Names of the codes and sub-codes	References	Percentage %
Organization Restructuring	36	26.0
Clear work process	18	13.0
Implementation of best practices	3	2.2
Inventory management eased	3	2.2
Assistance from other agencies and well-wishers	12	8.7
Resource Availability	28	20.3
Skilled maintenance staff	12	8.7
Support from external sources	8	5.8
Appointment of supervisor & focal point	8	5.8
	29	9.0

Enhancement of repair speed		
Improved availability of spare parts	13	5.6
Attending promptly to repairs	10	3.5
Efficient coordination with outside technicians	6	4.3
Improvement to the documentation process	18	13.0
Improved documentation practices	12	8.7
Streamline record keeping	6	4.3
Communication improvement	27	19.6
Effective communication with maintenance personnel	12	8.7
Improved communication with staff members	15	10.7
Total	138	100

Table 4: Mean score of statements of the satisfaction, space and traceability in the pre & post- intervention period.

Serial No:	Domain	Pre (n =38)			Post (n=38)			Sig.
		Mean	SD	Interpretation mean score	Mean	SD	Interpretation mean score	Paired-test, p
1	Satisfaction	2.38	0.56	Average	3.87	0.31	High	15.75, p<0.001
2	Space	3.91	0.85	High	2.41	0.54	Average	9.37, p<0.001
3	Traceability	3.22	0.58	Average	4.03	0.46	High	7.83, p<0.001

Table 5: Number and percentage of resurrected selected inventory items

Name of the unusable equipment	Number of items marked for condemning	Number resurrected	Percentage resurrected
Selected General Inventory Items			
Wheelchairs	64	50	78%
Patient trollies	38	30	79%
Patient beds	37	28	76%

Table 4 highlights that the interventions made for the unusable inventory items at D.G.H. Negombo had a positive impact on all three domains.

Since the mean scores can provide an overall summary of participants' attitudes or perceptions towards the various aspects

covered in the questionnaire, the mean score results obtained in this study endorse the researcher's assumptions made when planning the project and the intervention.

Number of selected inventory items resurrected through the interventions of the project.

Table 5 indicates that the research project's interventions were able to resurrect a reasonable number of items that had previously been condemned. General inventory items that were resurrected include fifty wheelchairs (78%), thirty patient trollies (79%), and twenty-eight patient beds (76%).

Discussion

The project at D.G.H. Negombo on resurrecting unusable general inventory items aligns with global efforts to extend the life cycle of medical equipment, improving efficiency, environmental outcomes, and sustainability. Financial benefits from resurrected equipment encourage hospitals to adopt this practice, integrating it into the global healthcare economy.⁶

In India, the demand for resurrected medical equipment is growing, especially in rural markets with cost sensitivity and low purchasing power.⁷ A study in Latin America highlights a shortage of qualified maintenance personnel, a situation mirrored in Sri Lanka.⁸

This project addressed issues such as spare parts shortages, technician deficiencies, and inadequate infrastructure. Interventions included engaging skilled volunteers and implementing repair and resurrection guidelines. Post-intervention evaluations showed significant improvements in repair activities, satisfaction levels, space utilization, and equipment traceability. Successful resurrection rates were 78% for wheelchairs, 79% for patient trolleys, and 76% for patient beds, increasing availability and cost savings.

However, the study's limitations include the selection of a limited number of items and challenges with external repairs and

volunteer availability, affecting the project's scope and effectiveness.

Conclusion

The project aimed to enhance the resurrection of general inventory items at D.G.H. Negombo, extending equipment lifespan and optimizing resource utilization. Significant gaps in technical proficiency and coordination were identified and addressed. The interventions led to notable improvements in resurrecting items that would have been condemned, saving costs and redirecting resources to patient care. Sustained efforts and collaboration with hospital authorities and stakeholders are crucial for continued success.

Recommendations

Continued Focus on Resurrection: Expand resurrection efforts with low-cost interventions and effective monitoring.

Engagement of Skilled Volunteers: Identify and engage skilled volunteers to support ongoing maintenance and optimization.

These recommendations will enhance operational efficiency and patient care outcomes at D.G.H. Negombo.

References

1. Mutia, D.M., Kihui, J. and Maranga, S.M. (2012). Maintenance Management of Medical Equipment in Hospitals. *Industrial Engineering Letters*, 2(3), pp.9–19.
2. Jamshidi, A., Rahimi, S.A., Ait-kadi, D. and Ruiz, A. (2015). A comprehensive fuzzy risk-based maintenance framework for prioritization of medical devices. *Applied Soft Computing*, 32, pp.322–334.

- doi:<https://doi.org/10.1016/j.asoc.2015.03.054>.
3. Koggalage, P.D. and De Alwis, S. (2019). A Project to Improve Management of Biomedical Equipment in Selected Units of District General Hospital, Gampaha, Sri Lanka. *International Journal of Research Foundation of Hospital and Healthcare Administration*, [online] 7(2), pp.67–74. doi:<https://doi.org/10.5005/jp-journals-10035-1109>.
 4. Dasanayaka, S. (2001) ‘Performance of Health Care Equipments in the Public Sector Hospitals in the Eye of Good Governance, A Case Study Based on the Sri Lankan Public Sector Hospitals’, (January 1986), pp. 1–25. Available at: http://www.napsipag.org/PDF/SARA_TH_DASANAYKA.pdf.
 5. Bahreini, R., Doshmangir, L. and Imani, A. (2019) ‘Influential factors on medical equipment maintenance management: In search of a framework’, *Journal of Quality in Maintenance Engineering*, 25(1), pp. 128–143. doi 10.1108/JQME-11-2017-0082.
 6. Kapoor, P., Harrington, C., Church, C., Gale, T., Tan, P. and Abou-Zaki, A., 2006. *Guide to Sustaining Existing Tower Blocks in the U.K. Comfort and Energy Use in Buildings*, pp.27-30.
 7. *Refurbished Medical Equipment: Challenges & Opportunities* (2015) GreenBook. Available at: <https://www.greenbook.org/marketing-research/refurbished-medical-equipment-challenges-opportunities-40073> [Accessed October 27 2022].
 8. Maxwell, R. J. (1985) ‘Resource Constraints and the Quality of Care’, *The Lancet*, 326(8461), pp. 936–939. doi: 10.1016/S0140-6736(85)90862-1.